## GROUP 37

# POWER STEERING

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# GENERAL INFORMATION

M1372000100821

Electric power steering has been adopted in all vehicles to make the steering system easier to handle.

## FEATURES

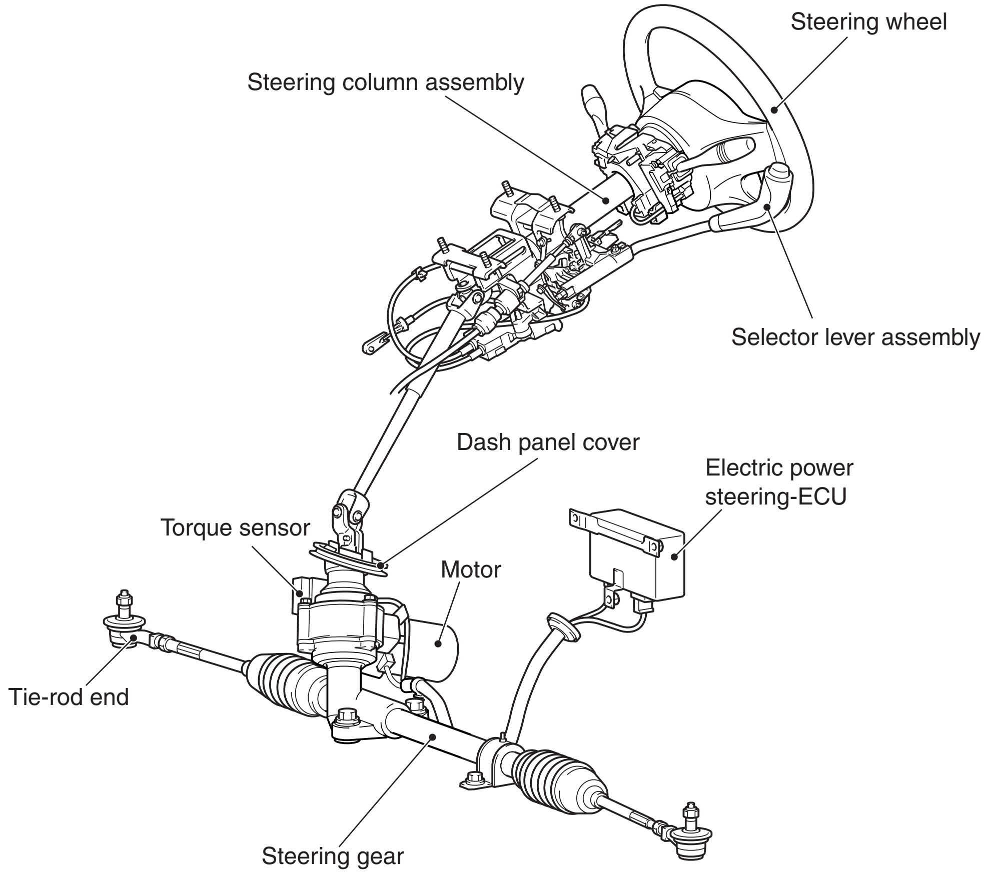
- Teflon resin for reduced friction has been adopted to the yoke bearing of steering gear and improve the operation performance.
- Improved fuel consumption by reduction of engine load, and weight saving by decrease of the number of parts have been achieved with the introduction of the electric power steering system.
- 3-spoke type steering wheel integrated with an SRS air bag has been adopted.
- Impact-absorbing mechanism and tilt steering mechanism have been adopted.

## SPECIFICATIONS

| **Item** | | **Specifications** | | |
|---|---|---|---|---|
| | | **Vehicles with 14-inch wheels** | **Vehicles with 15-inch wheels** | **Vehicles with 16-inch wheels** |
| Steering wheel | Type | 3-spoke type | | |
| | Outside diameter mm | 370 | | |
| | Maximum number of turns | 3.4 | 3.2 | 2.6 |
| Steering column | Column mechanism | Shock absorbing mechanism and tilt steering mechanism | | |
| Power steering type | | Electric powered type | | |
| Steering gear | Type | Rack and pinion | | |
| | Stroke ratio (Rack stroke/Steering wheel maximum turning radius) | 44.15 | | 50.46 |
| | Rack stroke mm | 150 | 143 | 130 |
| Steering angle | Inner wheel | 41 ° 40’ | 39 ° 00’ | 34 ° 10’ |
| | Outer wheel | 35 ° 30’ | 33 ° 40’ | 30 ° 00’ |

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## CONSTRUCTION DIAGRAM



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# SERVICE SPECIFICATIONS

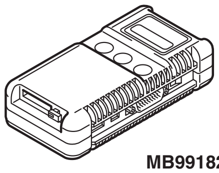
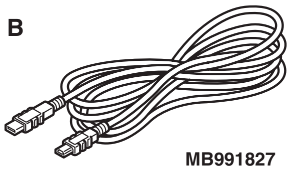
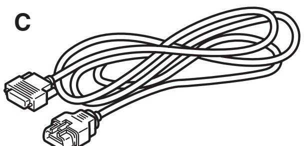
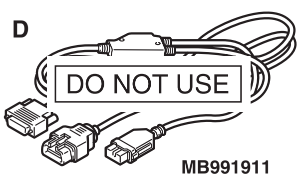
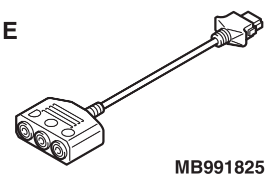
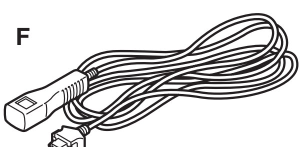
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| Item | | | Standard value | Limit |
|---|---|---|---|---|
| Steering wheel free play mm | | | – | 30 |
| Steering angle | Inner wheel | Vehicles with 14-inch wheels | 41° 40' ± 1° 30' | – |
| | | Vehicles with 15-inch wheels | 39° 00' ± 1° 30' | – |
| | | Vehicles with 16-inch wheels | 34° 10' ± 1° 30' | – |
| | Outer wheel (reference) | Vehicles with 14-inch wheels | 35° 30' | – |
| | | Vehicles with 15-inch wheels | 33° 40' | – |
| | | Vehicles with 16-inch wheels | 30° 00' | – |
| Tie rod end ball joint turning torque N·m | | | 10 or less | – |
| Stationary steering force N [Fluctuation allowance N] | | 4A9 | 25 or less [6.0 or less] | – |
| | | 4G1 | 40 or less [10.0 or less] | – |
| Total rotational torque of pinion N·m | Total rotational torque | 4A9 | 1.29 – 2.23 | – |
| | | 4G1 | 1.4 – 2.32 | – |
| | Torque fluctuation | 4A9 | 0.92 or less | – |
| | | 4G1 | 0.61 or less | – |
| Tie rod swing resistance N [Tie rod swing torque N·m] | | | 6 – 19 (1.5 – 4.9) | – |

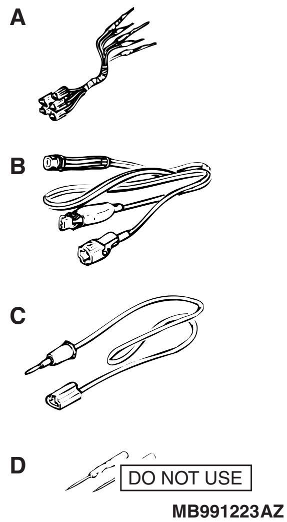
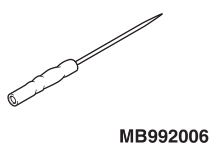
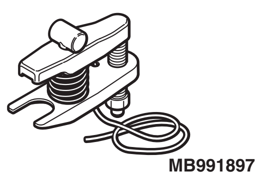
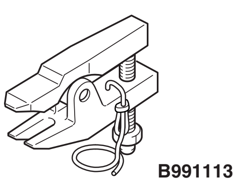
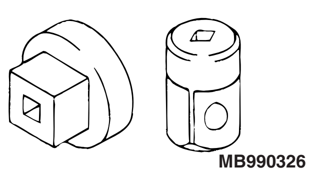
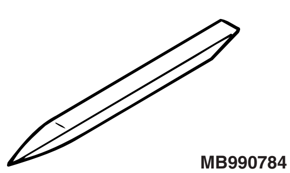
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# SPECIAL TOOLS

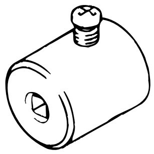
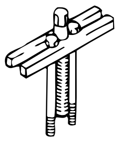
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| Tool | Number | Name | Use |
|---|---|---|---|
| A<br><br>MB991824<br>B<br><br>MB991827<br>C<br><br>MB991910<br>D<br><br><br>MB991911<br>E<br><br>MB991825<br>F<br><br>MB991826<br>MB991955 | MB991955<br>A: MB991824<br>B: MB991827<br>C: MB991910<br>D: MB991911<br>E: MB991825<br>F: MB991826 | M.U.T.-III sub-assembly<br>A: Vehicle Communication Interface (V.C.I.)<br>B: M.U.T.-III USB cable<br>C: M.U.T.-III main harness A (Vehicles with CAN communication system)<br>D: M.U.T.-III main harness B (Vehicles without CAN communication system)<br>E: M.U.T.-III measure adapter<br>F: M.U.T.-III trigger harness | CAN bus diagnosis<br>⚠ **CAUTION**<br>**For vehicles with CAN communication, use M.U.T.-III main harness A to send simulated vehicle speed. If you connect M.U.T.-III main harness B instead, the CAN communication does not function correctly.** |

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| Tool | Number | Name | Use |
|---|---|---|---|
|   | MB991223<br>A:MB991219<br>B:MB991220<br>C:MB991221<br>D:MB991222 | Harness set<br>A: Test harness<br>B: LED wiring harness<br>C: LED wiring harness adapter<br>D: Probe | Continuity check and voltage measurement at harness wire or connector<br>A: Contact pressure inspection at connector pin<br>B: Power supply circuit inspection<br>C: Power supply circuit inspection<br>D: Commercial tester connection |
|   | MB992006 | Extra fine probe | Making voltage and resistance measurement during troubleshooting |
|   | MB991897 or MB992011 | Ball joint remover | Knuckle and ball joint disconnection <Except RALLIART Version R><br>*NOTE: Steering linkage puller (MB990635 or MB991113)is also used to disconnect knuckle and tie rod end ball joint.* |
|   | MB991113 | Steering linkage puller | Knuckle and ball joint disconnection <RALLIART Version R> |
|   | MB990326 | Preload socket | Tie rod end ball joint turning torque check |
|   | MB990784 | Ornament remover | Cover removal |

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| Tool | Number | Name | Use |
|---|---|---|---|
|   | MB990228 or MB991006 | Preload socket | Steering gear total pinion torque check and adjustment |
|   | MB990803 | Steering wheel puller | Steering wheel disconnection |

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# TROUBLESHOOTING

## DIAGNOSIS TROUBLESHOOTING FLOW

M1372007300257

Refer to GROUP 00 – Contents of Troubleshooting P.00-5 .

## DIAGNOSTIC FUNCTION

M1372007400049

### HOW TO READ DIAGNOSIS CODE

Connect the M.U.T.-III to the 16-pin diagnosis connector, and read a diagnosis code (Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – Diagnosis Function P.00-7).

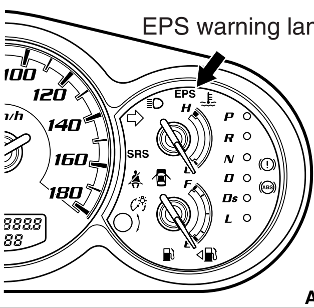
### How to erase diagnosis code

Connect the M.U.T.-III to the 16-pin diagnosis connector, and erase a diagnosis code (Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – Diagnosis Function P.00-7).

## CHECK OF ELECTRIC POWER STEERING WARNING LAMP

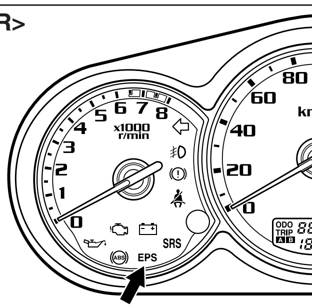
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<VRX>




AC510342 AB

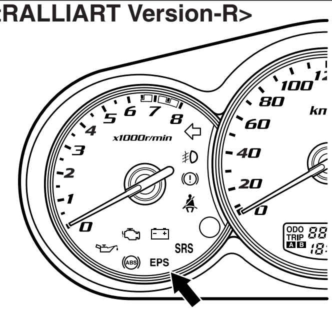
<LS and VR>




EPS warning lamp

AC510343 AC

<RALLIART Version-R>




EPS warning lamp

AC601682 AB

1. Check the electric power steering warning lamp illuminates as follows.
   - When the ignition switch is turned ON, the electric power steering warning lamp illuminates until the engine is started. The lamp extinguishes after the engine is started.

*NOTE: Even if the ignition switch is turned to the ON position (within approximately 0.3 seconds) again immediately after it is turned to the LOCK (OFF) position, the electric power steering warning lamp does not illuminate.*

2. If the lamp does not operate as described above, the electric power steering system or the combination meter may be defective. Check for diagnosis code, and carry out diagnosis (Refer to P.37-9). If no diagnosis codes are set, carry out diagnosis by referring to the electric power steering warning lamp-related inspection items on the trouble symptom chart (Refer to P.37-71).

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## DIAGNOSIS CODE CHART

M1372007500046

⚠ CAUTION

- **During diagnosis, a diagnosis code associated with other system may be set when the ignition switch is turned on with connector(s) disconnected. On completion, confirm all systems for diagnosis code(s). If diagnosis code(s) are set, erase them all.**
- **If more than three minutes elapse after the ignition switch is turned ON without starting engine, the electric power steering-ECU may set diagnosis codes U1100 and U1102 as past trouble.**

| Diagnosis code No. | Diagnostic item | Reference pages or actions |
|---|---|---|
| C1511 | Torque sensor main system malfunction | P.37-10 |
| C1512 | Torque sensor sub system malfunction | |
| C1513 | Large difference between main torque sensor and sub torque sensor | P.37-19 |
| C1514 | Torque sensor power supply abnormality | P.37-25 |
| C1521 | Vehicle speed sensor input malfunction | P.37-29 |
| C1522 | Engine speed input malfunction | P.37-33 |
| C1531 | Motor terminal voltage abnormality | P.37-36 |
| C1532 | Over real current of motor | P.37-39 |
| C1533 | Motor current sensor problem | Replace the electric power steering-ECU (Refer to P.37-102). |
| C1534 | Under real current of motor | P.37-41 |
| C1541 | Fail-safe relay is stuck to ON. | Replace the electric power steering-ECU (Refer to P.37-102). |
| C1542 | Fail-safe relay stuck off. | P.37-44 |
| C1607 | Abnormal ECU (microcomputer) | Replace the electric power steering-ECU (Refer to P.37-102). |
| C1860 | Power supply voltage abnormality (high voltage) | P.37-48 |
| C1861 | Power supply voltage abnormality (low voltage) | P.37-50 |
| U1073 | Bus off | P.37-53 |
| U1100 | Engine-related time-out | P.37-55 |
| U1102 | CAN communication time-out with ABS-ECU | P.37-59 |
| U1120 | Engine-related failure information | P.37-63 |
| U1122 | ABS-ECU failure information | P.37-67 |

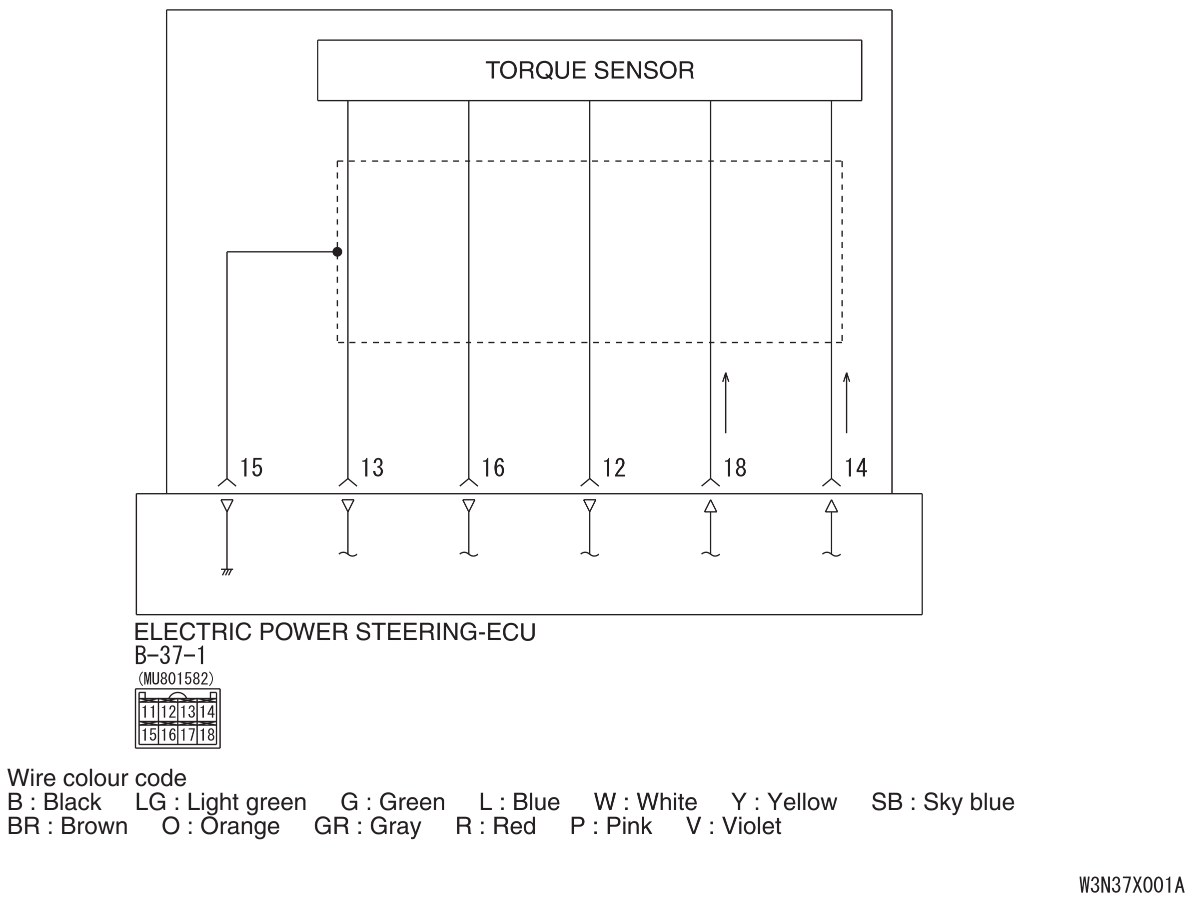
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# DIAGNOSTIC TROUBLE CODE PROCEDURES

**Code No.C1511: Torque sensor main system malfunction**
**Code No.C1512: Torque sensor sub system malfunction**

⚠ **CAUTION**
**Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**Torque Sensor Circuit**




## DIAGNOSIS CODE SET CONDITIONS

These diagnosis codes are set in the following case:

**C1511: Torque sensor main system malfunction**

- The torque sensor main output voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the torque sensor main system.

**Criteria for judging malfunction**

- The torque sensor main output voltage is more than 4.5 V or less than 0.5 V.

**C1512: Torque sensor sub system malfunction**

- The torque sensor sub output voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the torque sensor sub system.

**Criteria for judging malfunction**

- The torque sensor sub output voltage is more than 4.5 V or less than 0.5 V.

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## PROBABLE CAUSES

**C1511: Torque sensor main system malfunction**

- Defective harness wire(s) or connector(s)
- Defective torque sensor of the steering gear and linkage assembly
- Malfunction of the electric power steering-ECU

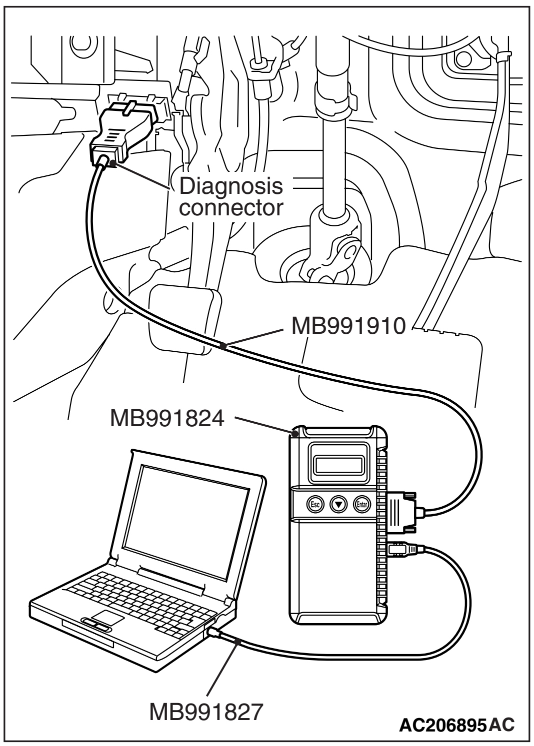
**C1512: Torque sensor sub system malfunction**

- Defective harness wire(s) or connector(s)
- Defective torque sensor of the steering gear and linkage assembly
- Malfunction of the electric power steering-ECU

## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III diagnosis code

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

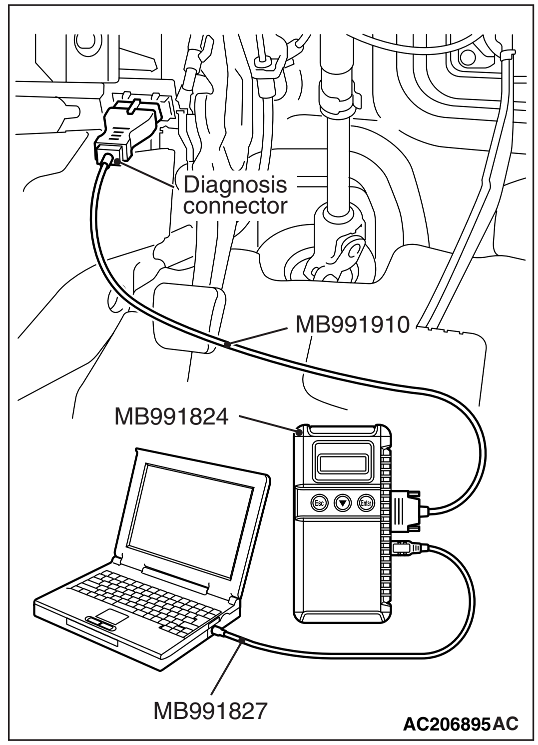
Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Start the engine, and check the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the diagnosis code status changed from "Stored" to "Active" when the engine is started?**
**YES : .** Go to Step 2.
**NO : .** Go to Step 12.

### STEP 2. M.U.T.-III diagnosis code

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

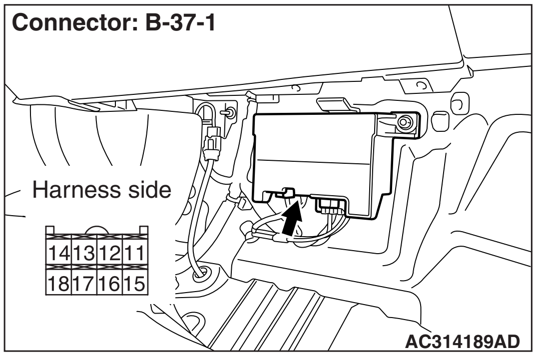
Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Check whether diagnosis codes C1511 and C1512 are set simultaneously.
(3) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Are diagnosis codes C1511 and C1512 set simultaneously?**
**YES :** Go to Step 8.
**NO :** Go to Step 3.

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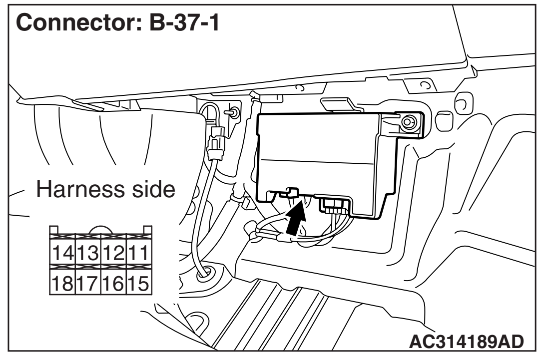
**STEP 3. Check the harness wires between electric power steering-ECU connector B-37-1 (terminals 13, 16 and 18) and torque sensor.**




**Q: Is any wire between electric power steering-ECU connector B-37-1 (terminals 13, 16 and 18) and torque sensor damaged?**

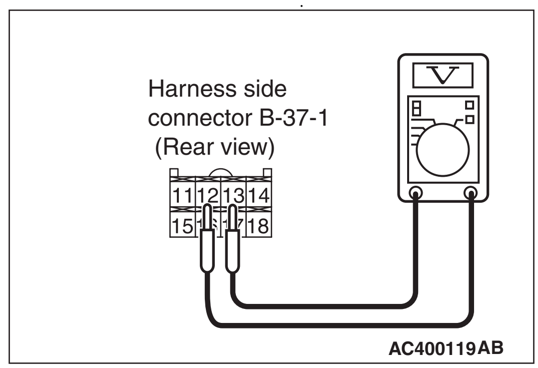
**YES :** Repair it.
**NO :** Go to Step 4.

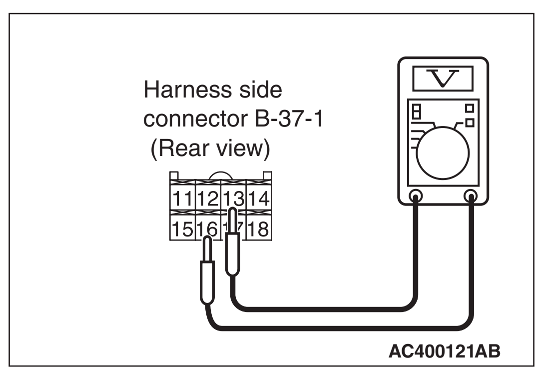
**STEP 4. Check the sensor signal lines for open circuit.**




Use the M.U.T.-III voltage measurement and data list functions to measure the torque sensor main voltage <C1511> or sub voltage <C1512> before the fail-safe relay is activated (one second after the engine is started) without disconnecting connector B-37-1 (by backprobing).

- The steering is in the neutral position.
- Item 01: Torque sensor main system (Refer to P.37-84).
- Item 02: Torque sensor sub system (Refer to P.37-84).
- Item 03: Torque sensor voltage (Refer to P.37-84).



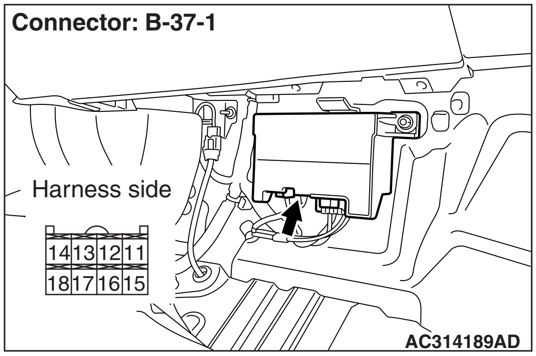

Measure the voltage between connector B-37-1 terminals 12 and 13 (for main system), and connector B-37-1 terminals 13 and 16 (for sub system).

**OK: 2.4 – 2.6 V**

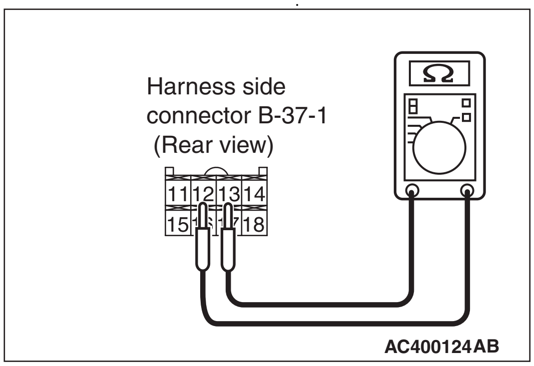
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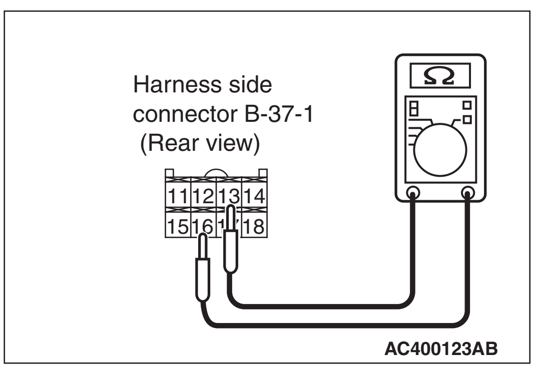
**Q: Is the check result normal?**
**YES :** Go to Step 7.
**NO :** Go to Step 5.

### STEP 5. Check the electric power steering-ECU for internal short to earth.




Disconnect electric power steering-ECU connector B-37-1, and measure the internal resistance in the ECU.



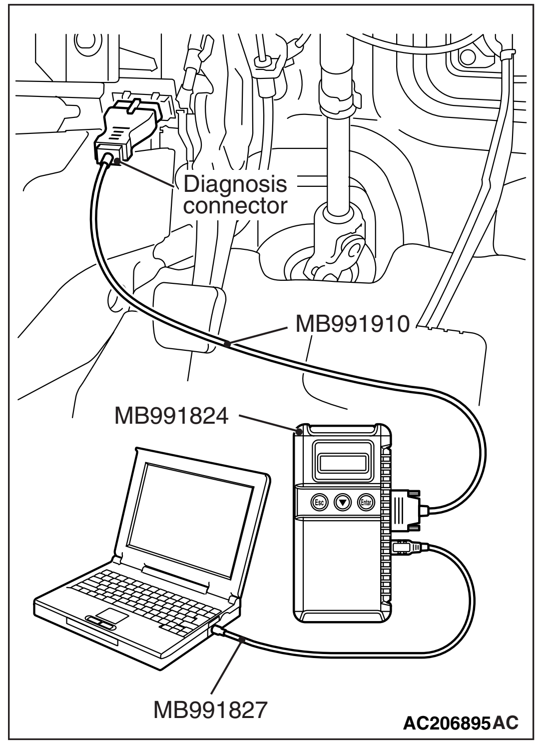

Measure the resistance between connector B-37-1 terminals 12 and 13 (for main system), and connector B-37-1 terminals 13 and 16 (for sub system).

**OK: 0.5k – 1.5 kΩ**

**Q: Is the check result normal?**
**YES :** Go to Step 6.
**NO :** Replace the electric power steering-ECU (Refer to P.37-102).

### STEP 6. Check whether the diagnosis code is reset.

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

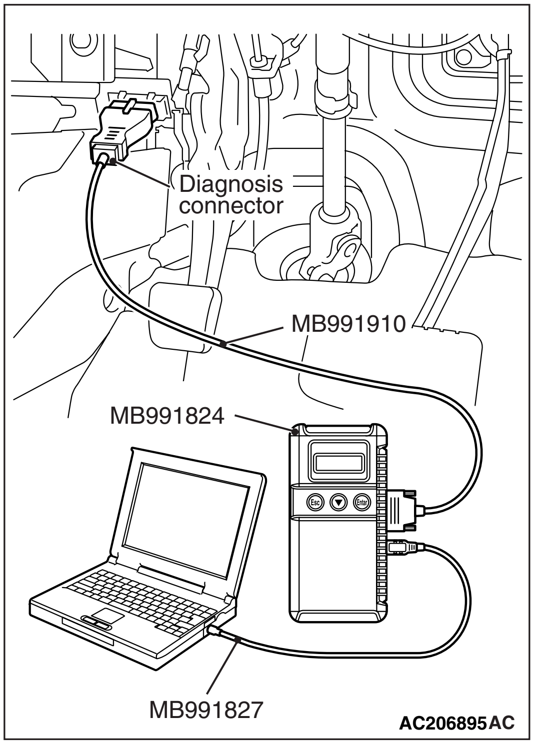
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and turn the steering wheel.
(6) Check if the diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is diagnosis code C1511 or C1512 set?**
**YES :** Replace the steering gear and linkage assembly (Refer to P.37-96).
**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

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### STEP 7. Check whether the diagnosis code is reset.

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

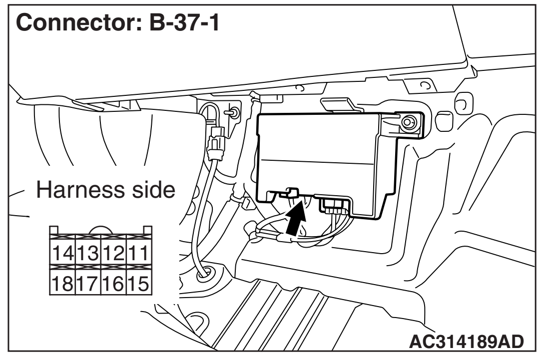
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and turn the steering wheel.
(6) Check if the diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is diagnosis code C1511 or C1512 set?**

**YES : .** Replace the electric power steering-ECU (Refer to P.37-102).

**NO : .** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

### STEP 8. Check the harness wires between electric power steering-ECU connector B-37-1 (terminals 13, 16 and 18) and torque sensor.



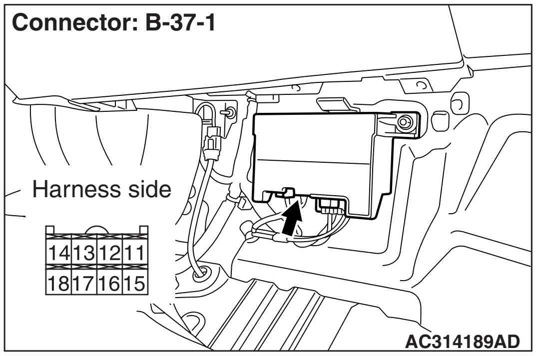

**Q: Is any wire between electric power steering-ECU connector B-37-1 (terminals 13, 16 and 18) and torque sensor damaged?**

**YES :** Repair it.

**NO :** Go to Step 9.

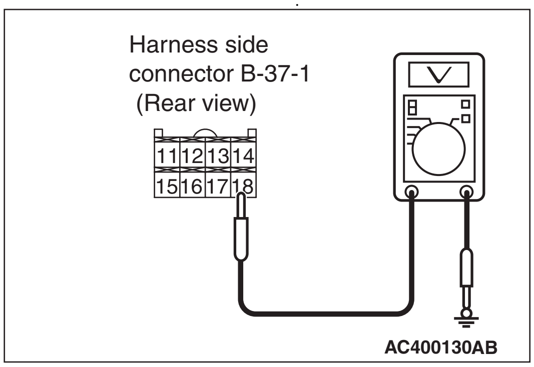
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### STEP 9. Check the 3-V power supply for open circuit.




Measure the voltage between the 3-V power supply (connector B-37-1 terminal 18) and body earth without disconnecting the connector (by backprobing).

- Ignition switch: ON (start the engine)



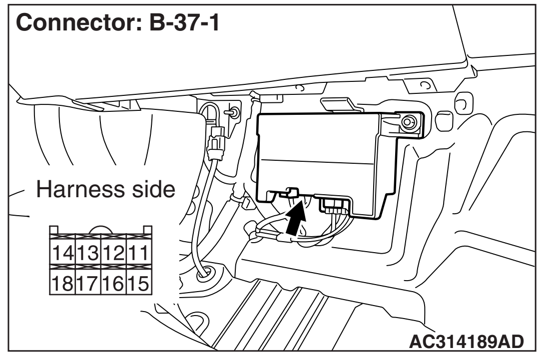

Measure the voltage between the 3-V power supply (connector B-37-1 terminal 18) and the body earth.

**OK: 2.88 – 3.12 V**

**Q: Is the check result normal?**

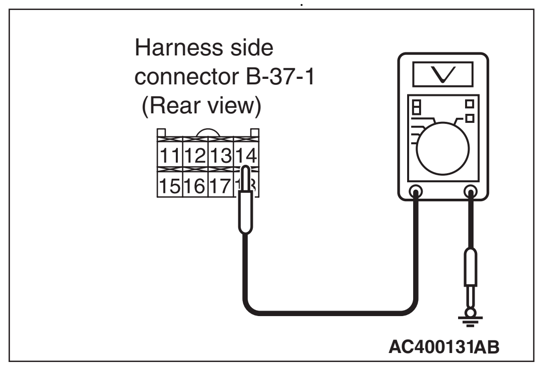
**YES :** Go to Step 10.
**NO :** Replace the electric power steering-ECU (Refer to P.37-102).

### STEP 10. Check the 8-V power supply for open circuit.




Measure the 8-V power supply voltage between connector B-37-1 terminal 14 and body earth without disconnecting the connector (by backprobing). Disconnect electric power steering-ECU, and measure the internal resistance in the ECU.

- Ignition switch: ON




Measure the voltage between the 8-V power supply (connector B-37-1 terminal 14) and the body earth.

**OK: 7.5 – 8.5 V**

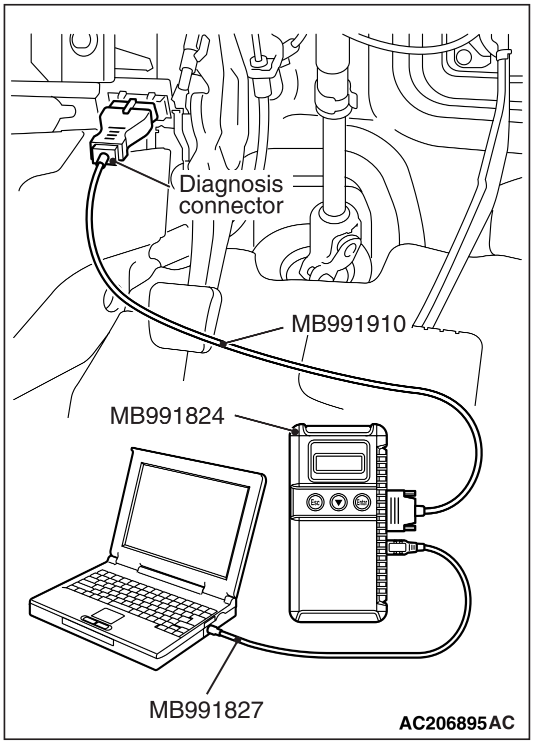
**Q: Is the check result normal?**

**YES :** Go to Step 11.
**NO :** Replace the electric power steering-ECU (Refer to P.37-102).

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### STEP 11. Check whether the diagnosis code is reset

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and turn the steering wheel.
(6) Check if the diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.

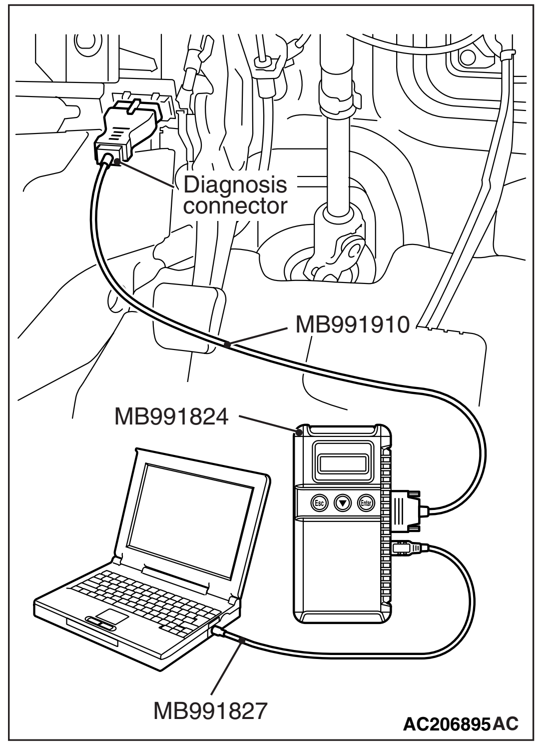
**Q: Is diagnosis code C1511 or C1512 set?**

**YES :** Replace the steering gear box and linkage assembly (Refer to P.37-96).

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

### STEP 12. M.U.T.-III diagnosis code

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) After starting the engine, check whether diagnosis code C1514 is set.
(3) Turn the ignition switch to the "LOCK" (OFF) position.

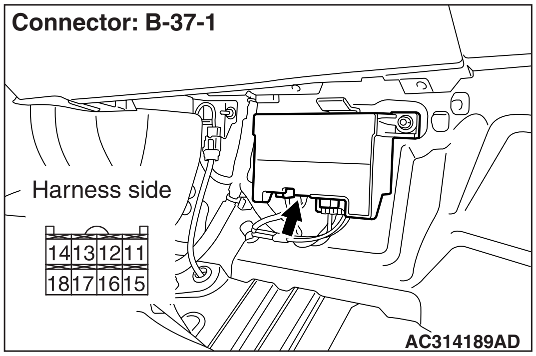
**Q: Is the status of diagnosis code C1514 stored as "Active"?**

**YES :** Go to Step 13.

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

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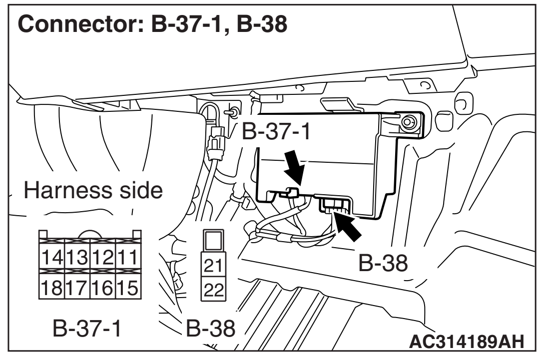
### STEP 13. Check the harness wires between electric power steering-ECU connector B-37-1 (terminal 13) and torque sensor.



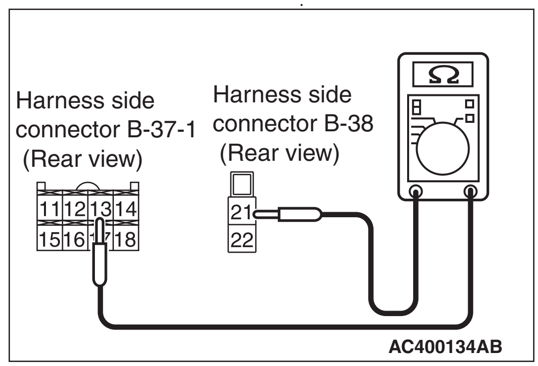

**Q: Is any wire between electric power steering-ECU connector B-37-1 (terminal 13) and torque sensor damaged?**

**YES :** Repair it.
**NO :** Go to Step 14.

### STEP 14. Check the earth circuit to the electric power steering-ECU for open circuit.




Disconnect electric power steering-ECU connectors B-38 and B-37-1, and measure the internal resistance in the ECU.




Measure the resistance between connector B-38 terminal 21 and connector B-37-1 terminal 13.

**OK: Continuity exists (2 Ω or less)**

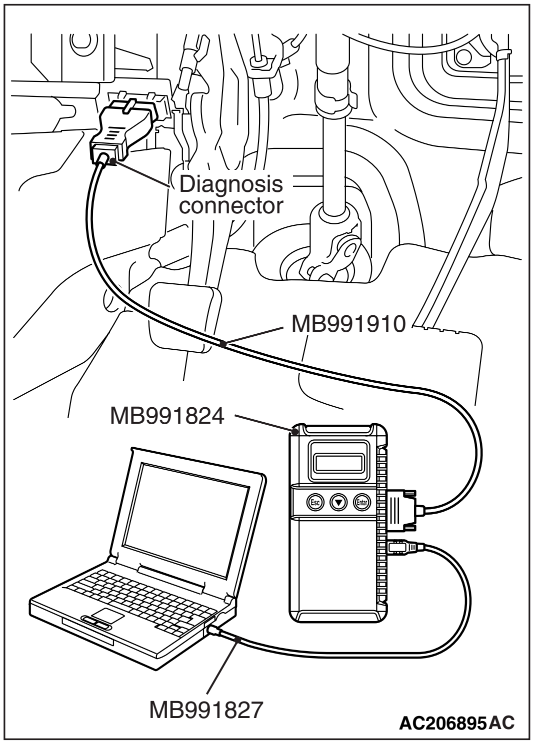
**Q: Is the check result normal?**

**YES :** Go to Step 15.
**NO :** Replace the electric power steering-ECU (Refer to P.37-102).

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**STEP 15. Check whether the diagnosis code is reset**

⚠ **CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and turn the steering wheel.
(6) Check if the diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.
(8) Disconnect M.U.T.-III.

**Q: Is diagnosis code set?**

**YES :** Replace the steering gear and linkage assembly (Refer to P.37-96).

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

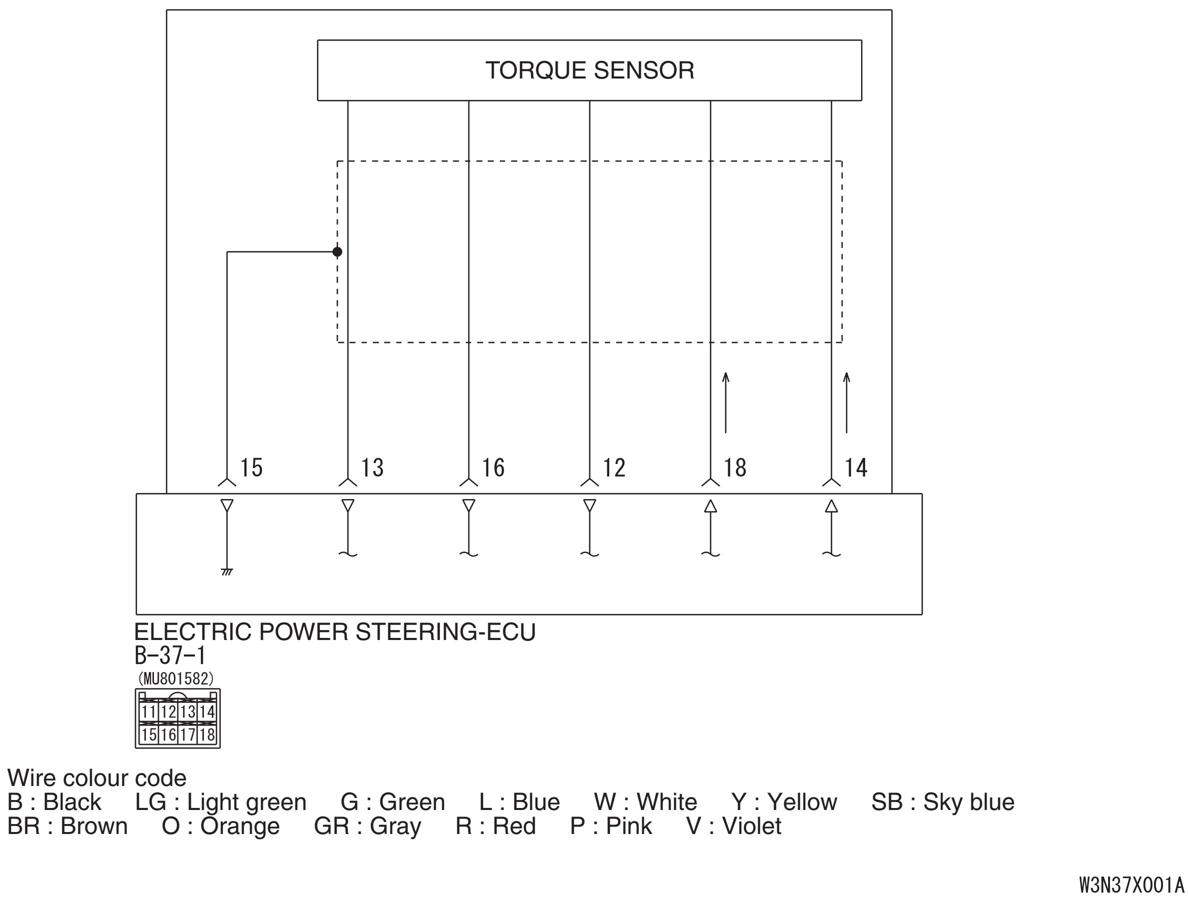
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## Code No.C1513 Large difference between main torque sensor and sub torque sensor

⚠ CAUTION

**Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**Torque Sensor Circuit**




## DIAGNOSIS CODE SET CONDITIONS

- The sum of the torque sensor main output voltage and sub output voltage does not meet a predetermined value stored in the microcomputer, and the microcomputer determines that a problem has occurred in the mutual monitoring for the sensor main/sub systems.

**Criteria for judging malfunction**

- The sum of the torque sensor main output voltage and sub output voltage is more than 5.3 V or less than 4.7 V.

## PROBABLE CAUSES

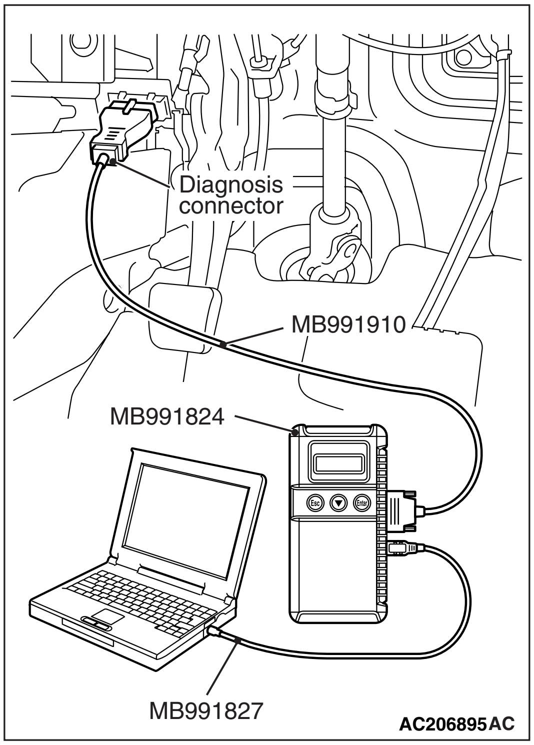
- Defective harness wire(s) or connector(s)
- Defective torque sensor of the steering gear and linkage assembly
- Malfunction of the electric power steering-ECU

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## DIAGNOSTIC PROCEDURE

### STEP 1. Check whether the diagnosis code is reset

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

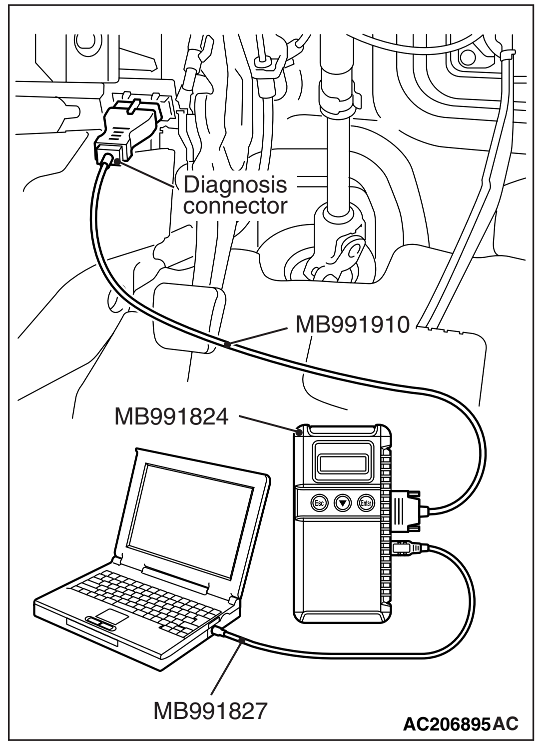
(1) Turn the ignition switch to the "ON" position.
(2) Start the engine, and check the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is diagnosis code C1513 (status: active) set?**

**YES :** Go to Step 6.
**NO :** Go to Step 2.

### STEP 2.M.U.T.-III diagnosis code

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

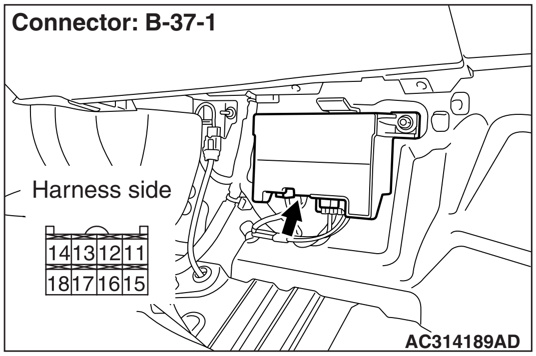
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Check whether diagnosis code C1511 or C1512 is set as past trouble.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is diagnosis code C1511 or C1512 set as stored trouble?**

**YES :** Go to Step 3.
**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

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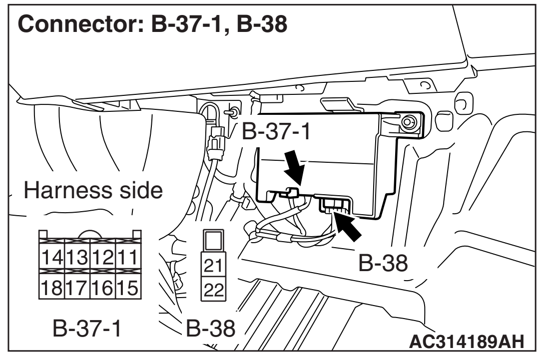
### STEP 3. Check the harness wires between electric power steering-ECU connector B-37-1 (terminals 13, 16 and 18) and torque sensor.



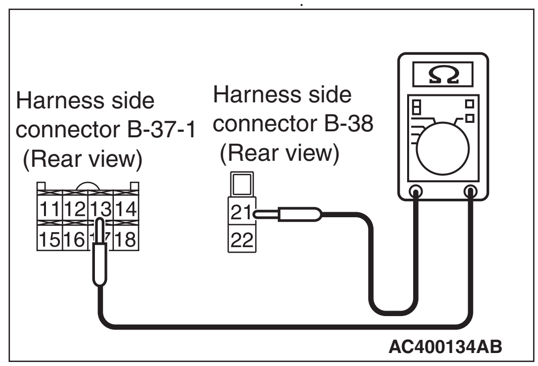

**Q: Is any wire between electric power steering-ECU connector B-37-1 (terminals 13, 16 and 18) and torque sensor damaged?**

**YES :** Repair it.
**NO :** Go to Step 4.

### STEP 4. Check the earth circuit to the electric power steering-ECU for open circuit.




Disconnect electric power steering-ECU connectors B-38 and B-37-1, and measure the internal resistance in the ECU.




Measure the resistance between connector B-38 terminal 21 and connector B-37-1 terminal 13.

**OK: Continuity exists (2 Ω or less)**

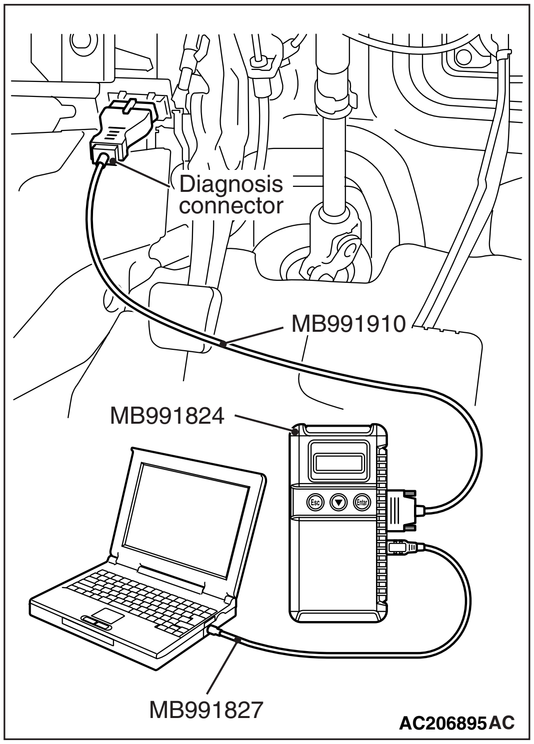
**Q: Is the check result normal?**

**YES :** Go to Step 5.
**NO :** Replace the electric power steering-ECU (Refer to P.37-102).

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### STEP 5. Check whether the diagnosis code is reset

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

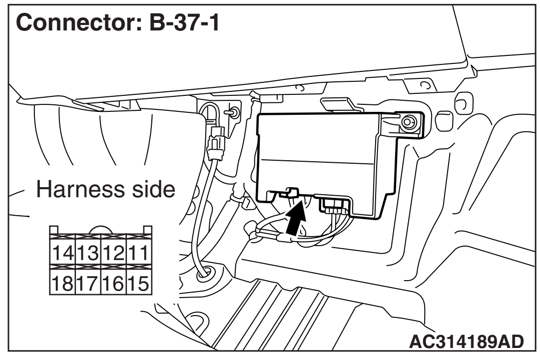
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and turn the steering wheel.
(6) Check if the diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is diagnosis code set?**

**YES : .** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

**NO : .** Replace the steering box and linkage assembly (Refer to P.37-96).

### STEP 6. Check the torque sensor for short to earth or open circuit.




- Harness wire between electric power steering-ECU connector B-37-1 and the torque sensor
- Check electric power steering-ECU connector B-37-1 and its terminals.

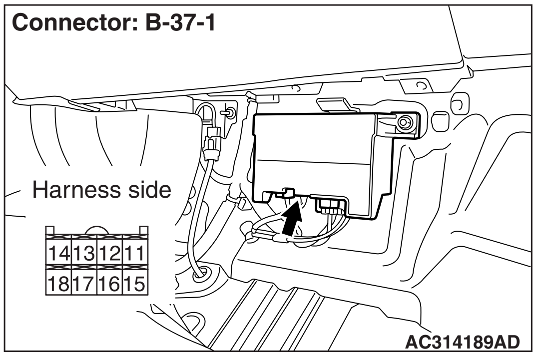
**Q: Are the wiring harness and the connectors in good condition?**

**YES :** Go to Step 7.

**NO :** Repair the wiring harness or the connector(s).

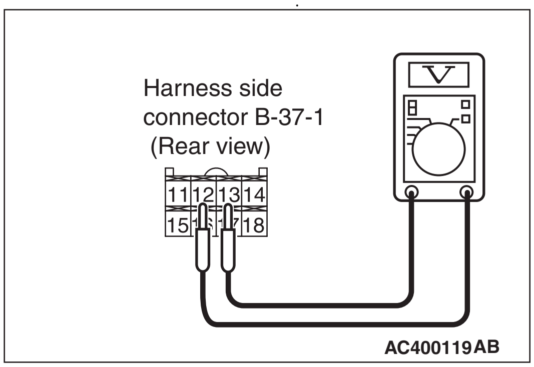
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### STEP 7. Check the torque sensor output voltage.

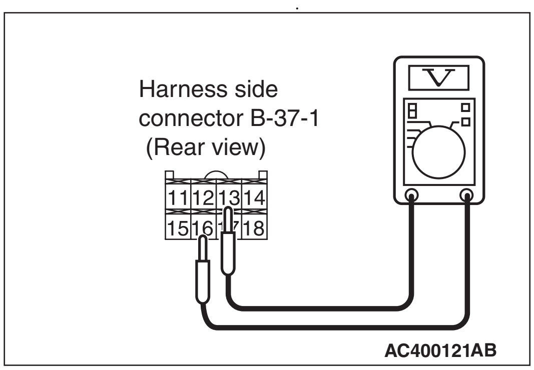



Use the M.U.T.-III voltage measurement and data list functions to measure the torque sensor main voltage or sub voltage before the fail-safe relay is activated (one second after the engine is started) without disconnecting connector B-37-1 (by backprobing).

- The steering is in the neutral position.
- Item 01: Torque sensor main system (Refer to P.37-84).
- Item 02: Torque sensor sub system (Refer to P.37-84).
- Item 03: Torque sensor voltage (Refer to P.37-84).




Measure the voltage between connector B-37-1 terminals 12 and 13 (for main system)




Measure the voltage between connector B-37-1 terminals 13 and 16 (for sub system)

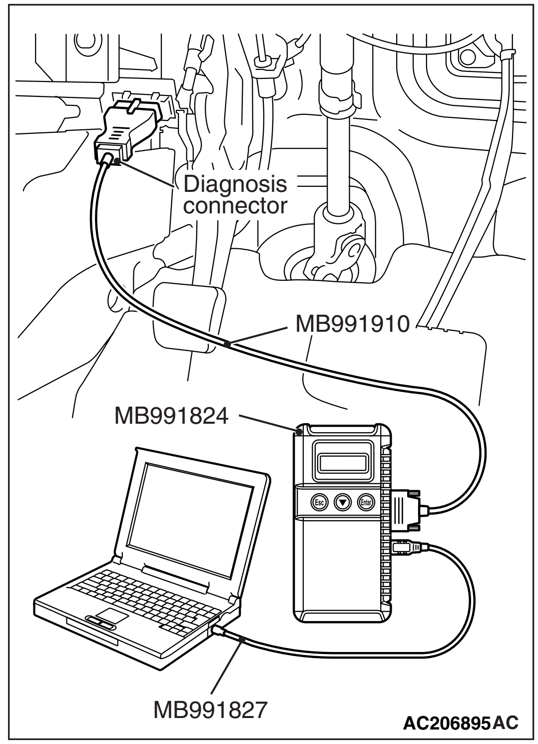
**OK: 2.4 – 2.6 V**

**Q: Is the check result normal?**

**YES :** Go to Step 8.
**NO :** Go to Step 9.

### STEP 8. Check whether the diagnosis code is reset

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

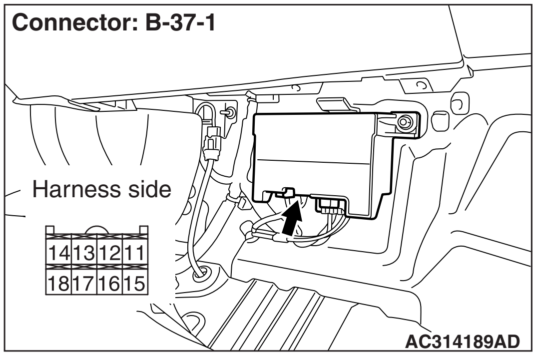
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and check the diagnosis code.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is diagnosis code C1513 set?**

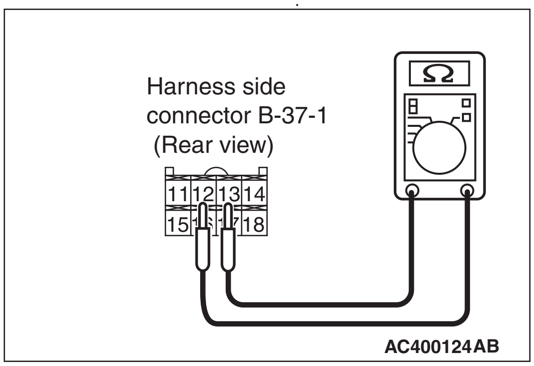
**YES :** Replace the electric power steering-ECU (Refer to P.37-102).
**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

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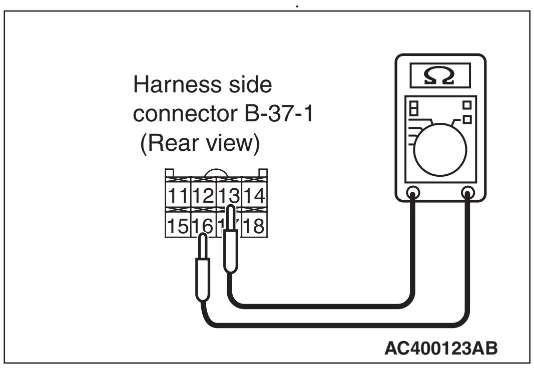
### STEP 9. Check the sensor circuit of the electric power steering-ECU for short to earth.




Disconnect electric power steering-ECU connector B-37-1, and measure the internal resistance in the ECU.




Measure the resistance between connector B-37-1 terminals 12 and 13.<Main>




Measure the resistance between connector B-37-1 terminals 13 and 16.<Sub>

**OK: 0.5 – 1.5 kΩ**

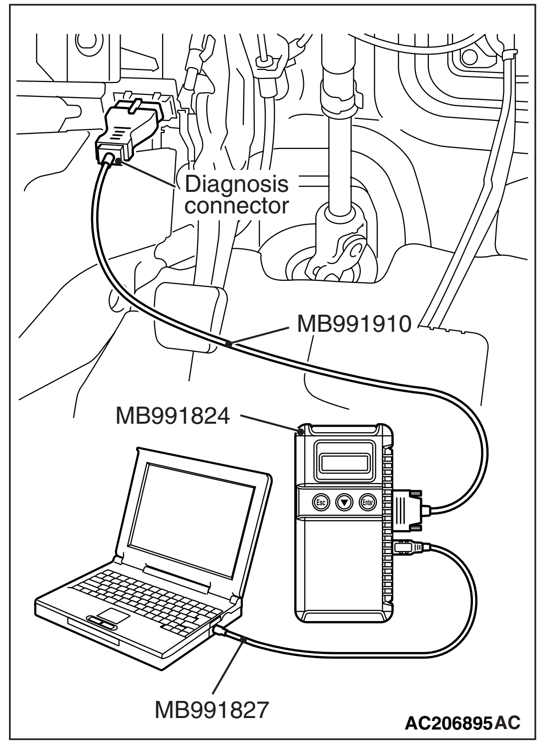
**Q: Is the check result normal?**

**YES :** Go to Step 10.

**NO :** Replace the steering gear and linkage assembly (Refer to P.37-96).

### STEP 10. Check whether the diagnosis code is reset.

⚠ **CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and check the diagnosis code.
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1513 set?**

**YES :** Replace the steering gear box and linkage assembly (Refer to P.37-96).

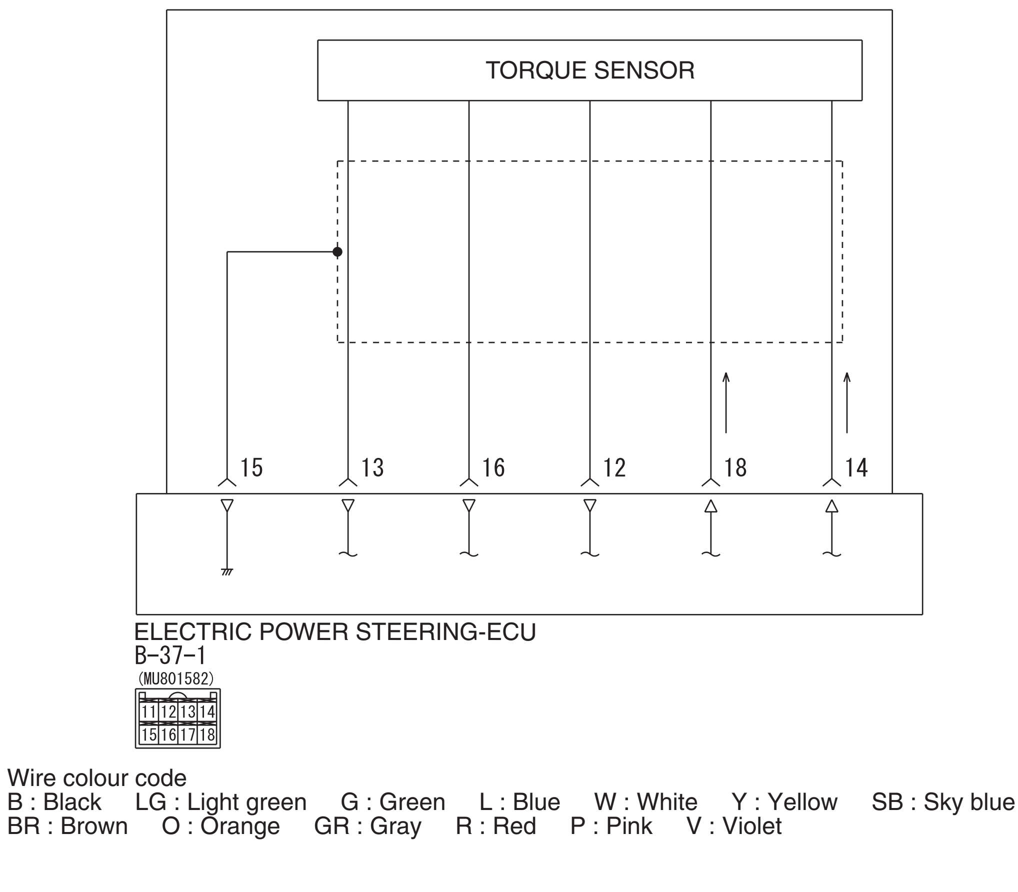
**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

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## Code No.C1514 Torque sensor power supply abnormality

**⚠ CAUTION**
**Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**Torque Sensor Circuit**




## DIAGNOSIS CODE SET CONDITIONS

- The torque sensor power supply monitor voltage does not meet a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the torque power supply voltage.

**Criteria for judging malfunction**

- The 8-V power supply voltage is more than 8.5 V or less than 7.5 V, or the 3-V power supply voltage is more than 3.12 V or less than 2.88 V.

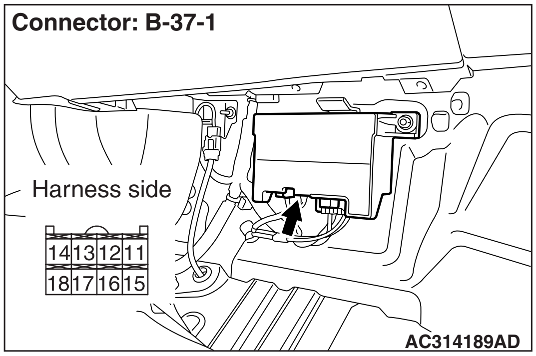
## PROBABLE CAUSES

- Defective harness wire(s) or connector(s)
- Defective torque sensor of the steering gear and linkage assembly
- The electric power steering-ECU is defective.

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## DIAGNOSTIC PROCEDURE

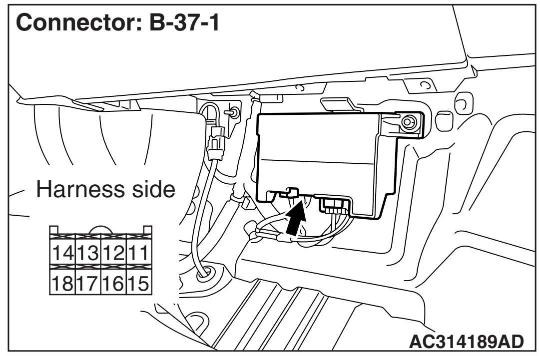
**STEP 1. Check the harness wires between electric power steering-ECU connector B-37-1 (terminals 13, 16 and 18) and torque sensor.**



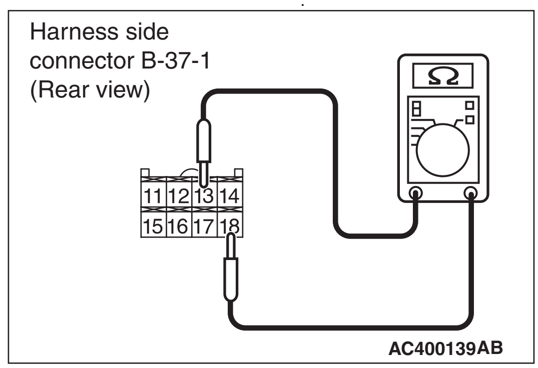

**Q: Is any wire between electric power steering-ECU connector B-37-1 (terminals 13, 16 and 18) and torque sensor damaged?**

**YES :** Repair it.
**NO :** Go to Step 2.

**STEP 2. Check for open circuit inside the steering gear box and linkage assembly.**




Disconnect electric power steering-ECU connector B-37-1, and measure the internal resistance in steering gear and linkage assembly.




Measure the resistance between connector B-37-1 terminals 13 and 18.

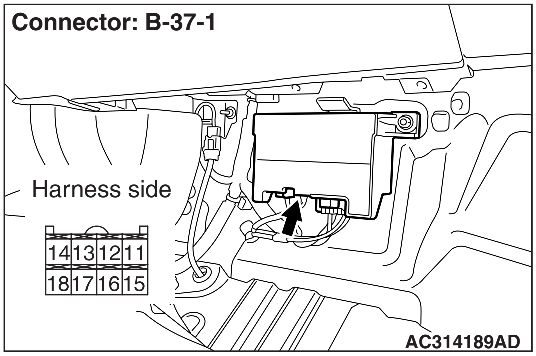
**OK: 400 – 800 Ω**

**Q: Is the check result normal?**

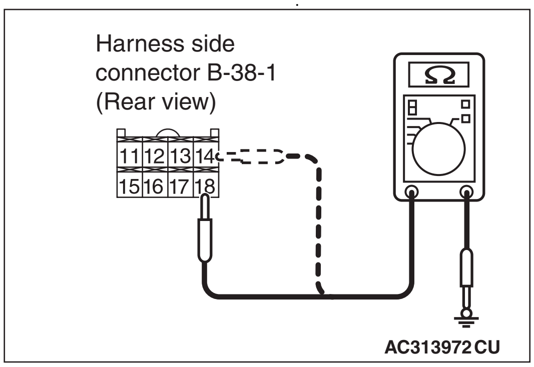
**YES :** Go to Step 3.
**NO :** Replace the steering gear and linkage assembly (Refer to P.37-96).

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**STEP 3. Check the power supply lines inside the torque sensor for open circuit.**

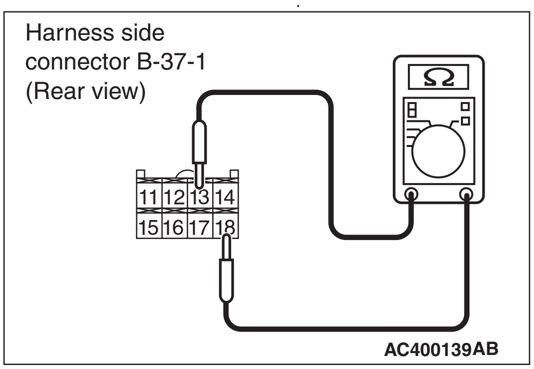



Disconnect electric power steering-ECU connector B-37-1, and measure the resistances between the connector-side terminals of the steering gear and linkage assembly.

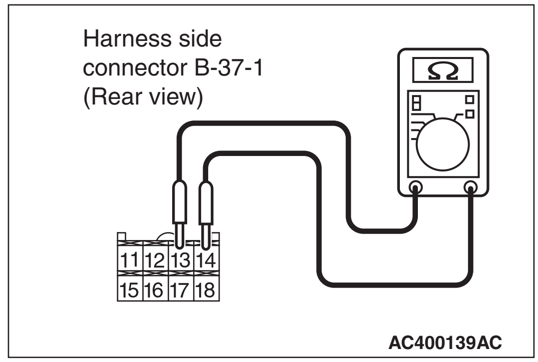



Between connector B-37-1 terminal 18 and body earth

- Between connector B-37-1 terminal 14 and body earth




Between connector B-37-1 terminals 18 and 13




Between connector B-37-1 terminals 14 and 13

**OK: 100 Ω or more**

**Q: Is the check result normal?**

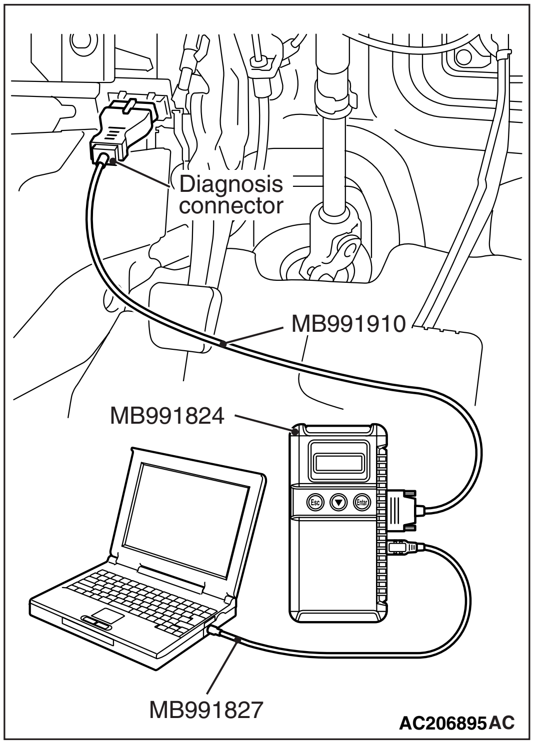
**YES :** Go to Step 4.

**NO :** Replace the steering gear and linkage assembly (Refer to P.37-96).

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**STEP 4. Check whether the diagnosis code is reset.**

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and check the diagnosis code.
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1514 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).

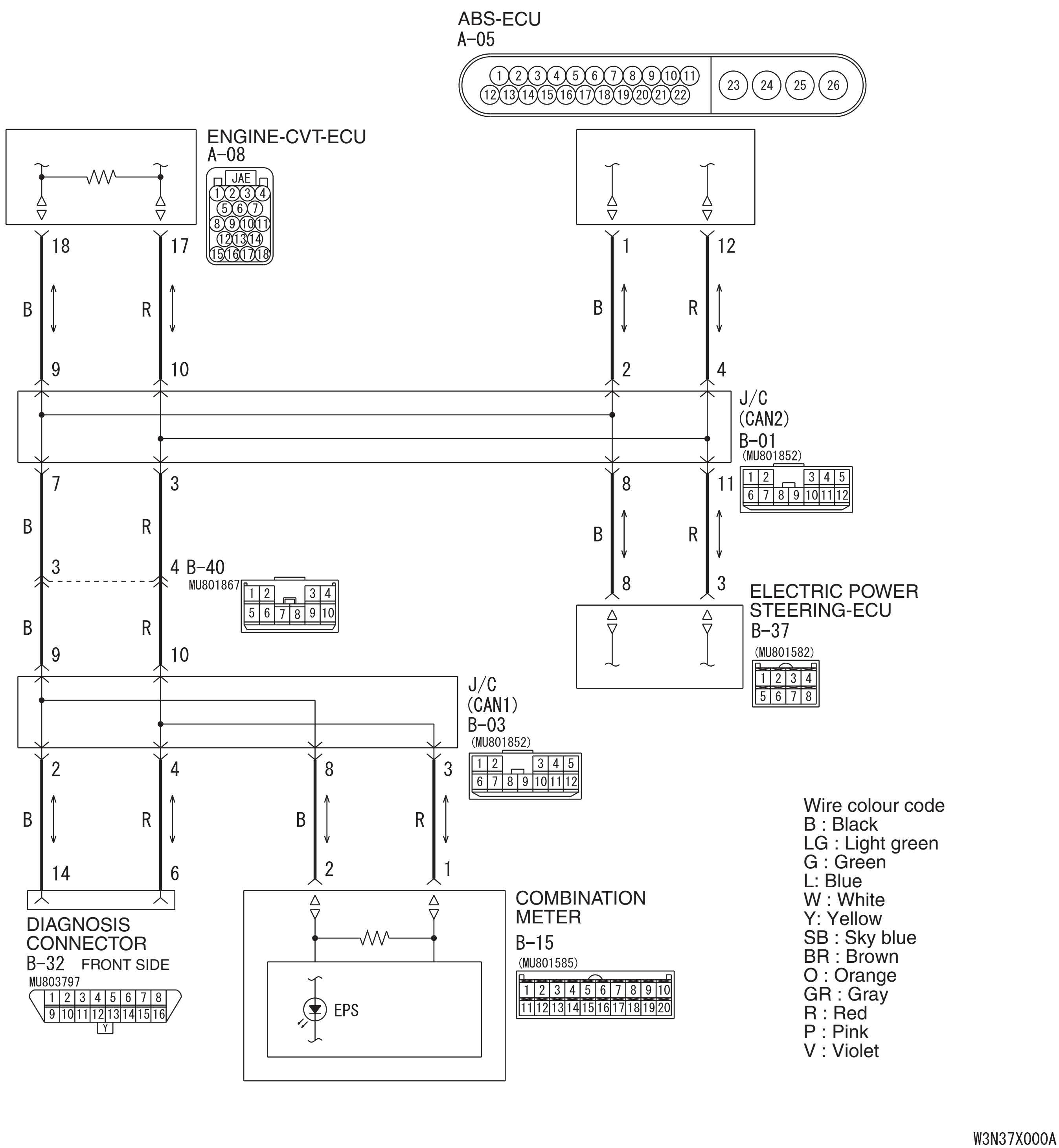
**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

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## Code No.C1521 Vehicle speed sensor input malfunction

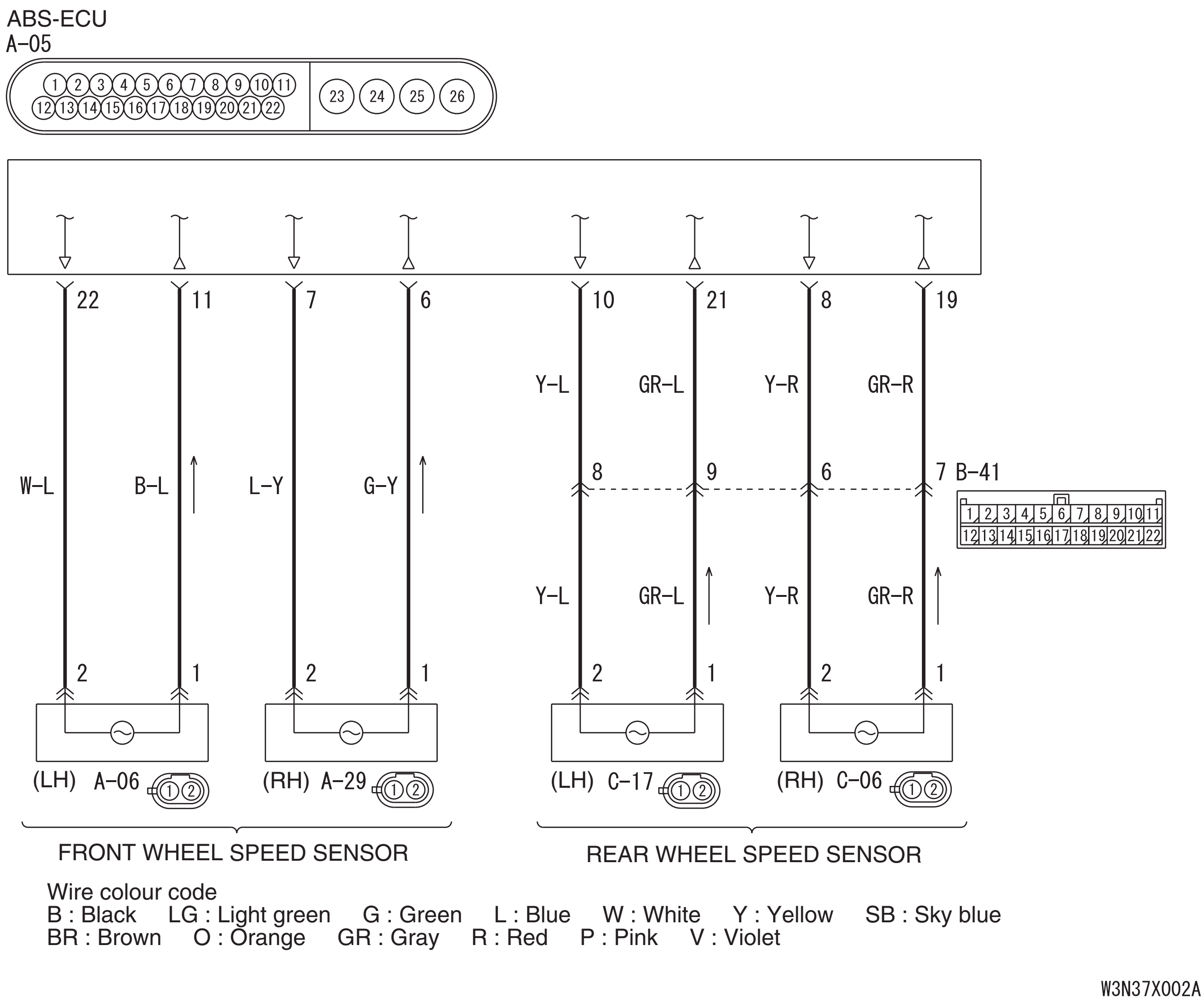
⚠ **CAUTION**
- **If the electric power steering-ECU sets diagnosis code No.C1521, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**CAN Communication Circuit**



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**Wheel Speed Sensor Circuit**




## DIAGNOSIS CODE SET CONDITIONS

This diagnosis code is set in the following case:

- If the system receives an abnormal vehicle speed signal and the microprocessor determines that the vehicle speed measurement system is defective.

### Criteria for judging malfunction

- The vehicle speed is 30 km/h or more and the vehicle speed signal is 0 km/h

## PROBABLE CAUSES

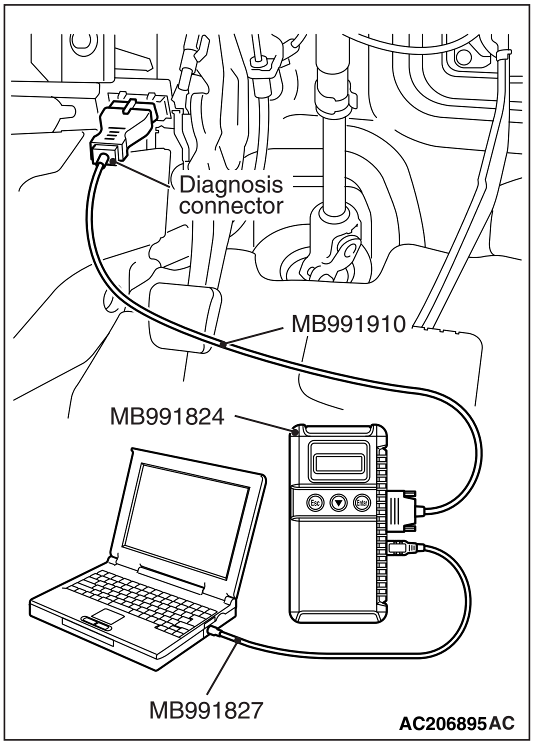
- Defective wire(s) or connector(s) in the wiring harness between the ABS-ECU and the wheel speed sensor
- Malfunction of the wheel speed sensor or vehicle speed detection encoder
- Defective power supply to the ABS-ECU
- Malfunction of the ABS-ECU
- Malfunction of the electric power steering-ECU

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## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III CAN bus diagnostics

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

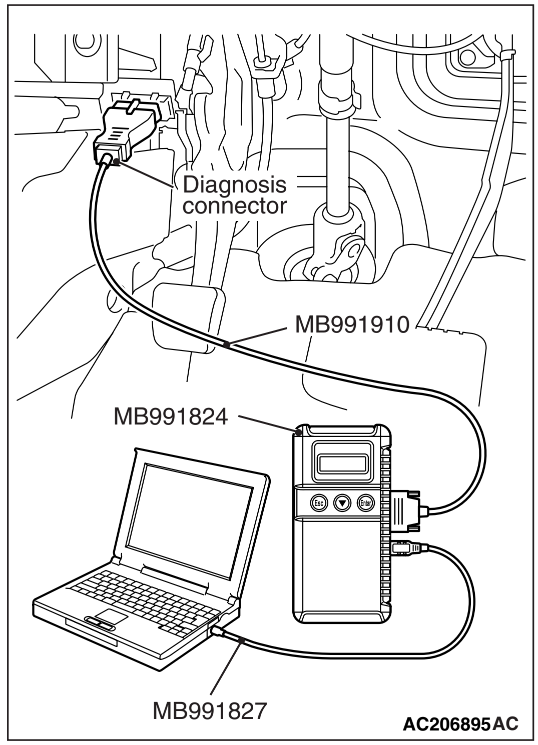
(1) Connect M.U.T.-III to the 16-pin diagnosis connector.
(2) Turn the ignition switch to the "ON" position.
(3) Diagnose the CAN bus line.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the check result normal?**

**YES :** Go to Step 2.
**NO :** Repair the CAN bus line (Refer to GROUP 54D, Diagnosis P.54D-13). Then go to Step 2.

### STEP 2. M.U.T.-III other system diagnosis code

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Check that a ABS system diagnosis code is set.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

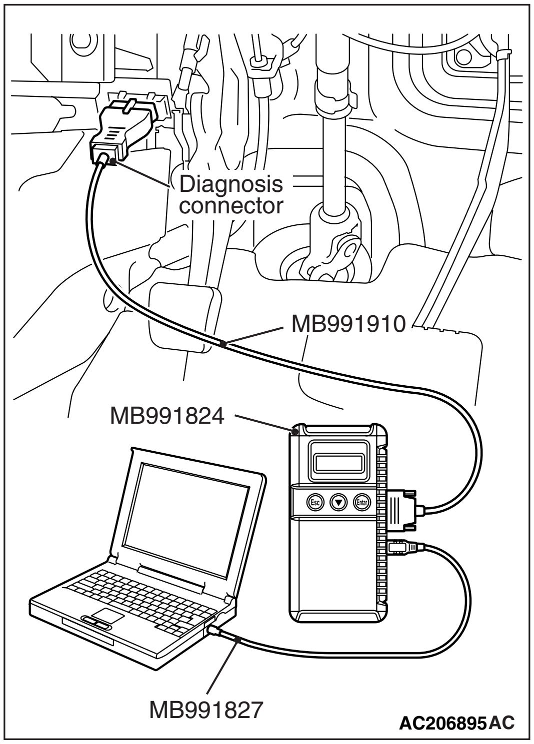
**Q: Is an ABS system diagnosis code set?**

**YES :** Diagnose the ABS system (Refer to GROUP 35B, Troubleshooting P.35B-7).
**NO :** Go to Step 3.

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### STEP 3. Check whether the diagnosis code is reset.

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Recheck whether diagnosis code C1521 is set.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

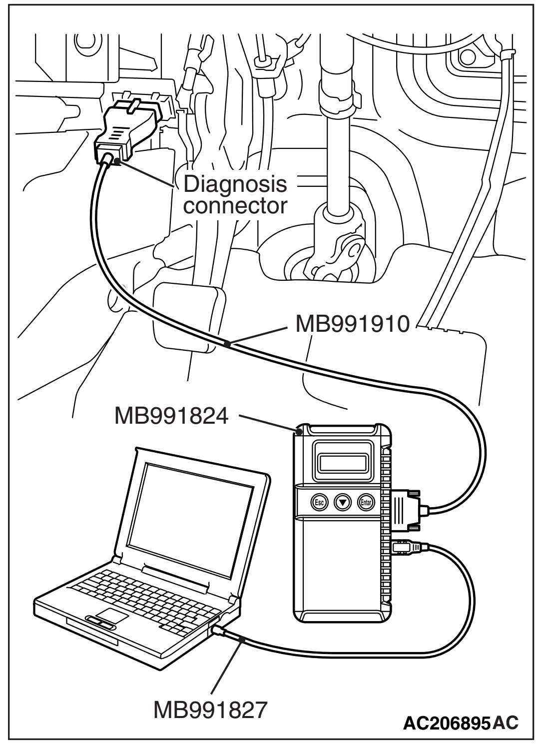
**Q: Is diagnosis code C1521 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102). Then go to Step 4.

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

### STEP 4. Check whether the diagnosis code is reset.

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Recheck whether diagnosis code C1521 is set.
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1521 set?**

**YES :** Replace the hydraulic unit (Integrated with ABS-ECU) (Refer to GROUP 35B, Hydraulic Unit P.35B-78 ).

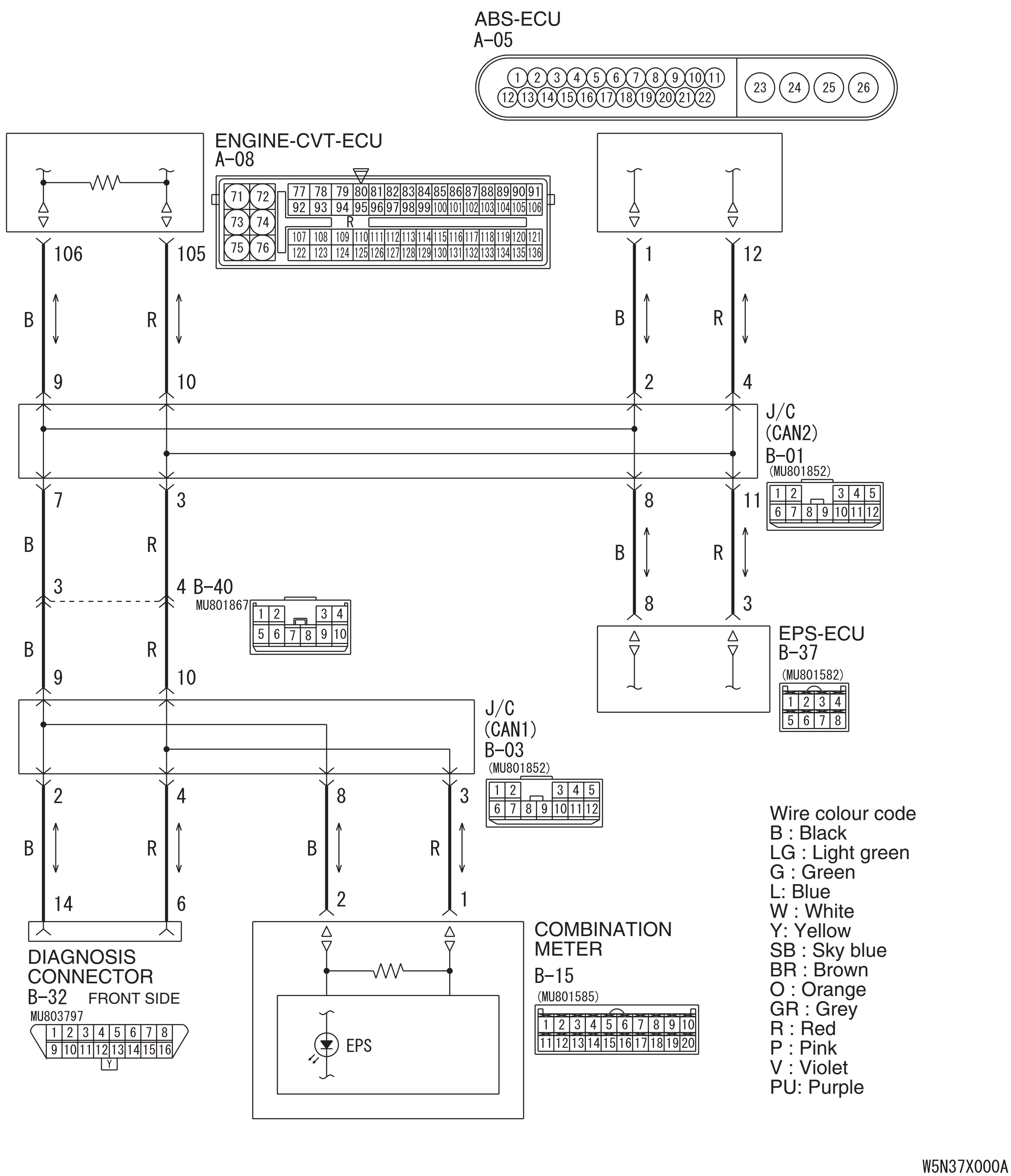
**NO :** This diagnosis is complete.

## Code No.C1522 Engine speed input malfunction

**⚠ CAUTION**

- **If the electric power steering-ECU sets diagnosis code No.C1522, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**CAN Communication Circuit**



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## DIAGNOSIS CODE SET CONDITIONS

- If the system receives an abnormal engine speed signal and the microprocessor determines that the engine speed measurement system is defective.

**Criteria for judging malfunction**

- When the vehicle maintains the vehicle speed of 15 km/h or above and the engine speed signal stays 0 rpm for 60 seconds

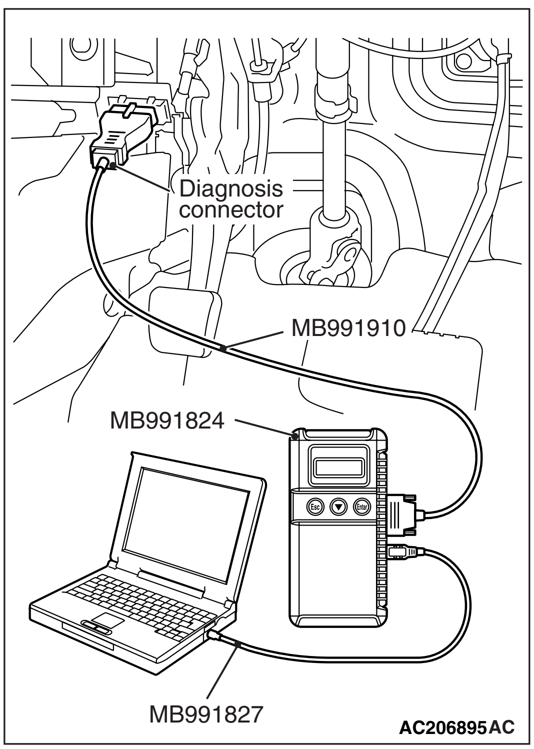
## PROBABLE CAUSES

- Defective wire(s) or connector(s) in the crankshaft angle sensor input circuit of the engine-CVT-ECU
- Malfunction of the engine-CVT-ECU
- Malfunction of the electric power steering-ECU
- The vehicle kept running with the engine stopped for 60 seconds or more.

## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III CAN bus diagnostics

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

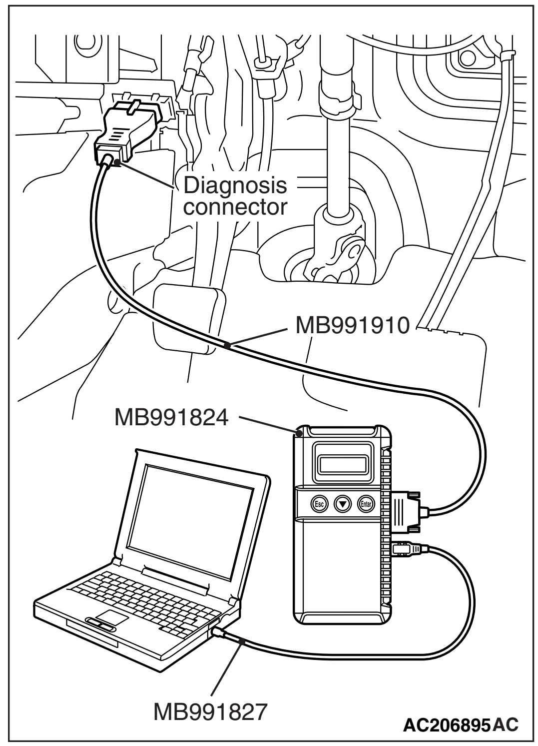
(1) Connect M.U.T.-III to the 16-pin diagnosis connector.
(2) Turn the ignition switch to the "ON" position.
(3) Diagnose the CAN bus line.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the check result normal?**

**YES :** Go to Step 2.
**NO :** Repair the CAN bus line (Refer to GROUP 54D, Diagnosis P.54D-13). Then go to Step 2.

### STEP 2. M.U.T.-III other system diagnosis code

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Check that an engine control system diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.

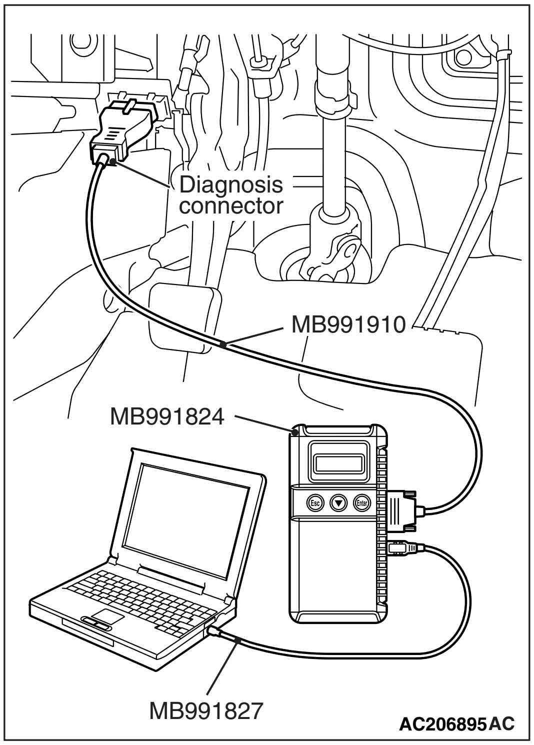
**Q: Is an engine control system diagnosis code set?**

**YES :** Diagnose the engine control system (Refer to GROUP 13A, Troubleshooting P.13A-20 <4A9>, GROUP 13B, Troubleshooting P.13B-18 <4G1>). Then go to Step 3.
**NO :** Go to Step 3.

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### STEP 3. M.U.T.-III data list

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Set M.U.T.-III to data reading mode, and check the data list item.
- Item 12: Engine speed
- Item 87: Tachometer (Refer to GROUP 54A, Combination meter – Data list reference table P.54A-59)

**OK: The tachometer normal and the reading on the tachometer nearly match the indication on M.U.T.-III.**

(7) Turn the ignition switch to the "LOCK" (OFF) position.

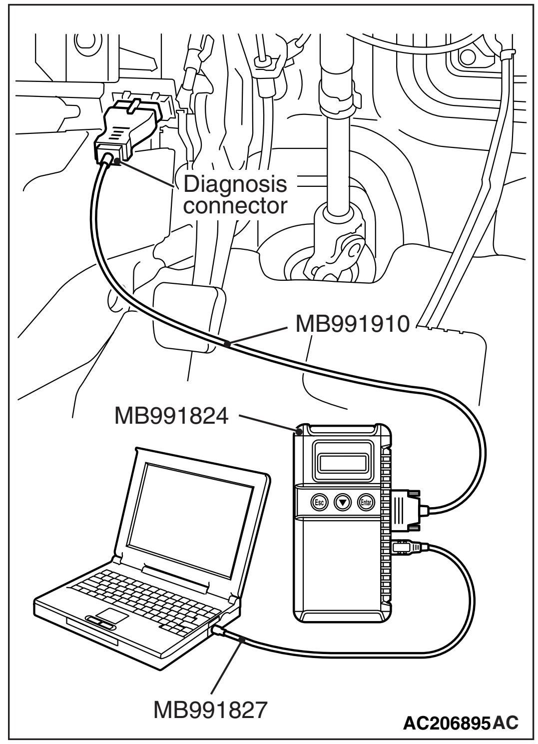
**Q: Is the engine speed input normal?**

**YES :** Go to Step 4.

**NO :** Replace the engine-CVT-ECU (Refer to GROUP 13A, Engine-CVT-ECU P.13A-372).

### STEP 4. Check whether the diagnosis code is reset.

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Recheck whether diagnosis code C1522 is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.
(8) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1522 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

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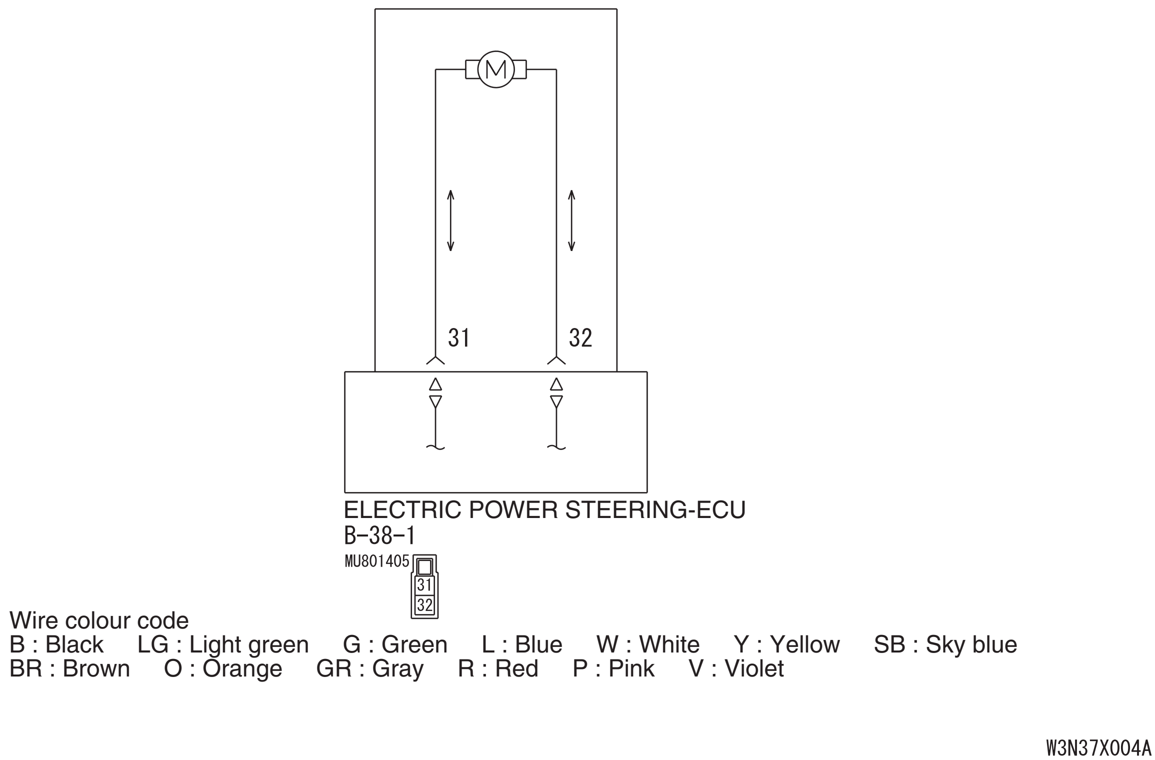
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## Code No.C1531 Motor terminal voltage abnormality

**⚠ CAUTION**

- **If the electric power steering-ECU sets diagnosis code No.C1531, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**Motor Circuit**




## DIAGNOSIS CODE SET CONDITIONS

- The motor terminal voltage does not meet a pre-determined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the motor terminal voltage.

**Criteria for judging malfunction**

- Right and left terminal voltages of the motor are less than 0.5 V.
- Both right and left terminal voltages of the motor are more than the power supply voltage – 1.13 V.

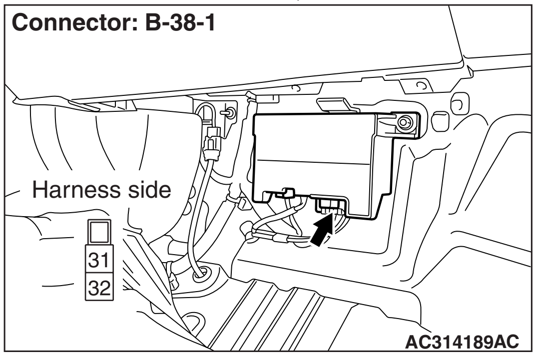
## PROBABLE CAUSES

- Defective harness wire(s) or connector(s)
- Defective motor of the steering gear and linkage assembly
- Malfunction of the electric power steering-ECU

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## DIAGNOSTIC PROCEDURE

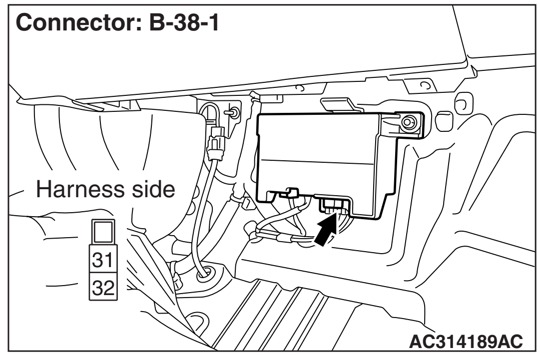
**STEP 1. Check the electric power steering-ECU connector B-38-1.**



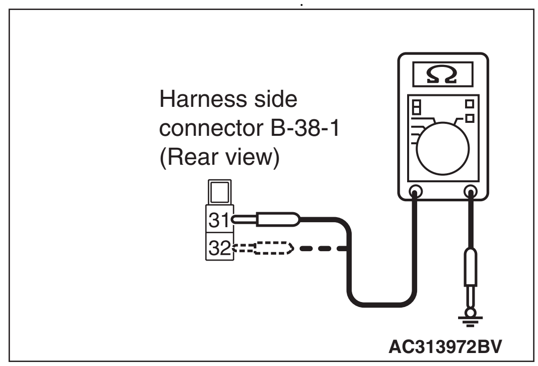

B-38-1 electric power steering-ECU connector
Check the connectors above for improper engagement, terminal damage or terminal drawn in the connector case.

**Q: Is the check result normal?**
**YES :** Go to Step 2.
**NO :** Repair the connector(s) or terminal(s).

**STEP 2. Check the motor wires of the steering gear and linkage assembly wiring harness for short to earth.**




Disconnect electric power steering-ECU connector B-38-1 and measure the resistance.




Measure the resistance between electric power steering-ECU connector B-38-1 terminal 31 and body earth.

- Measure the resistance between electric power steering-ECU connector B-38-1 terminal 32 and body earth.

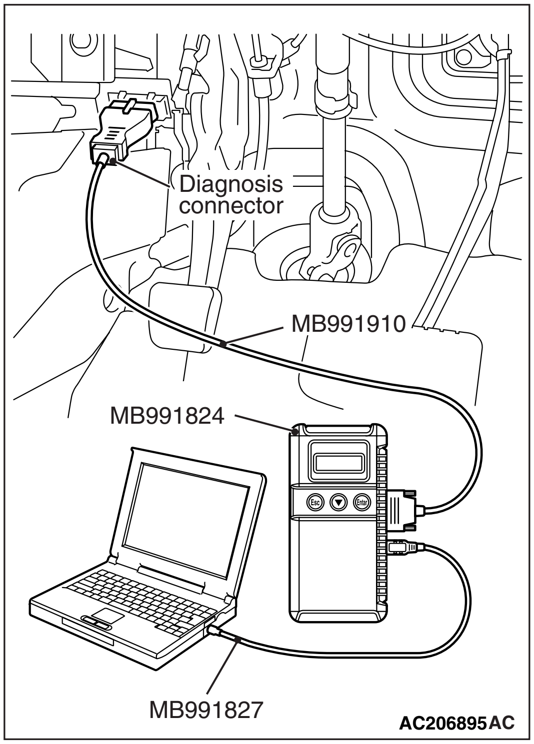
**OK: Open circuit or more than 300 Ω**

**Q: Is the check result normal?**
**YES :** Go to Step 3.
**NO :** Replace the steering gear and linkage assembly (Refer to P.37-96).

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**STEP 3. Check whether the diagnosis code is reset.**

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Recheck whether diagnosis code C1531 is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.
(8) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1531 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

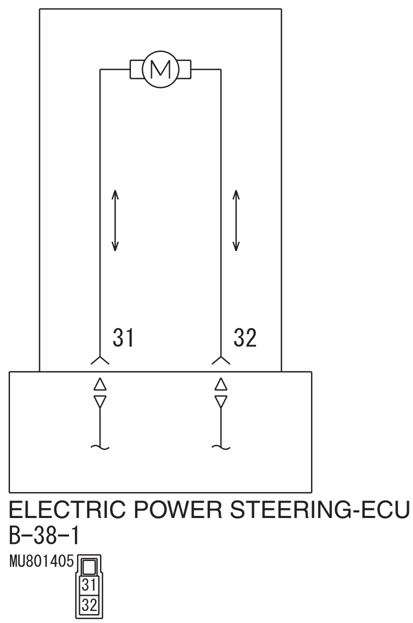
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## Code No.C1532 Over real current of motor

**⚠ CAUTION**

- **If the electric power steering-ECU sets diagnosis code No.C1532, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**Motor Circuit**




Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Gray R : Red P : Pink V : Violet

W3N37X004A

## DIAGNOSIS CODE SET CONDITIONS

- The motor current does not meet a predetermined limit stored in the microcomputer, and the microcomputer determines that there is a problem in the motor current limit.

**Criteria for judging malfunction**

- Actual measurement value of the motor current (absolute value) is more than 65 A

## PROBABLE CAUSES

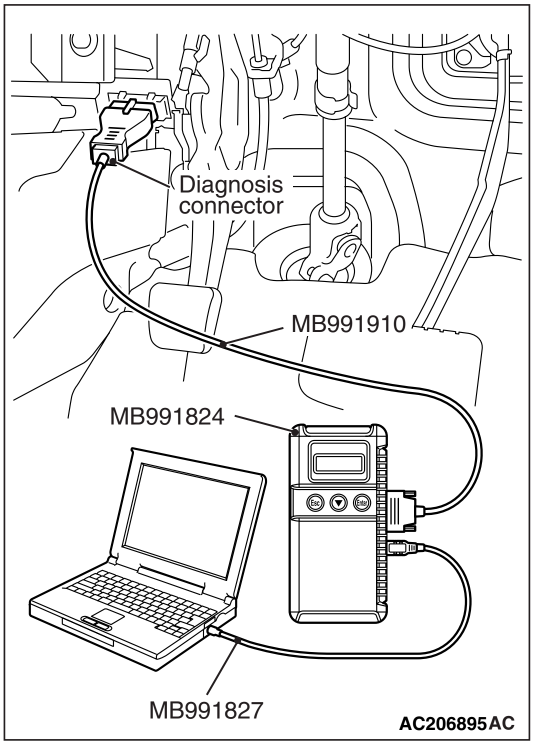
- Defective harness wire(s) or connector(s)
- Defective motor of the steering gear and linkage assembly
- Malfunction of the electric power steering-ECU

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## DIAGNOSTIC PROCEDURE

### STEP 1. M.U.T.-III diagnosis code

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

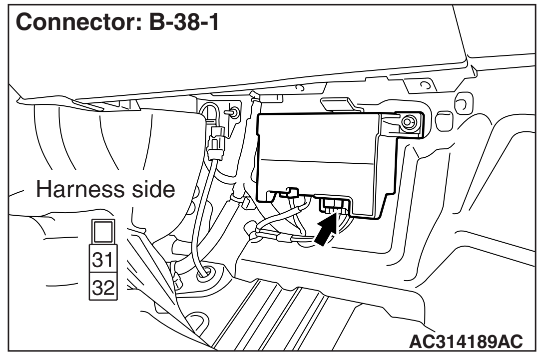
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and check the diagnosis code.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is diagnosis code C1531 set?**

**YES :** Carry out the troubleshooting for diagnosis code C1531 (Refer to P.37-36).

**NO :** Go to Step 2.

### STEP 2. Check the electric power steering-ECU connector B-38-1.




B-38-1 electric power steering-ECU connector

Check the connectors above for improper engagement, terminal damage or terminal drawn in the connector case.

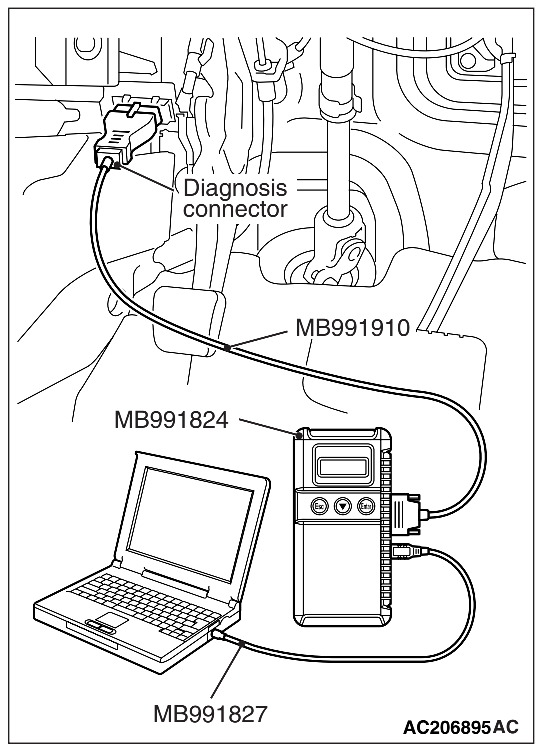
**Q: Is the check result normal?**

**YES :** Go to Step 3.

**NO :** Repair the connector(s) or terminal(s).

### STEP 3. Check whether the diagnosis code is reset.

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.

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(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Check if the diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.
(8) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1532 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102). If the concern is not eliminated after the electric power steering-ECU is replaced, replace the power steering gear box.

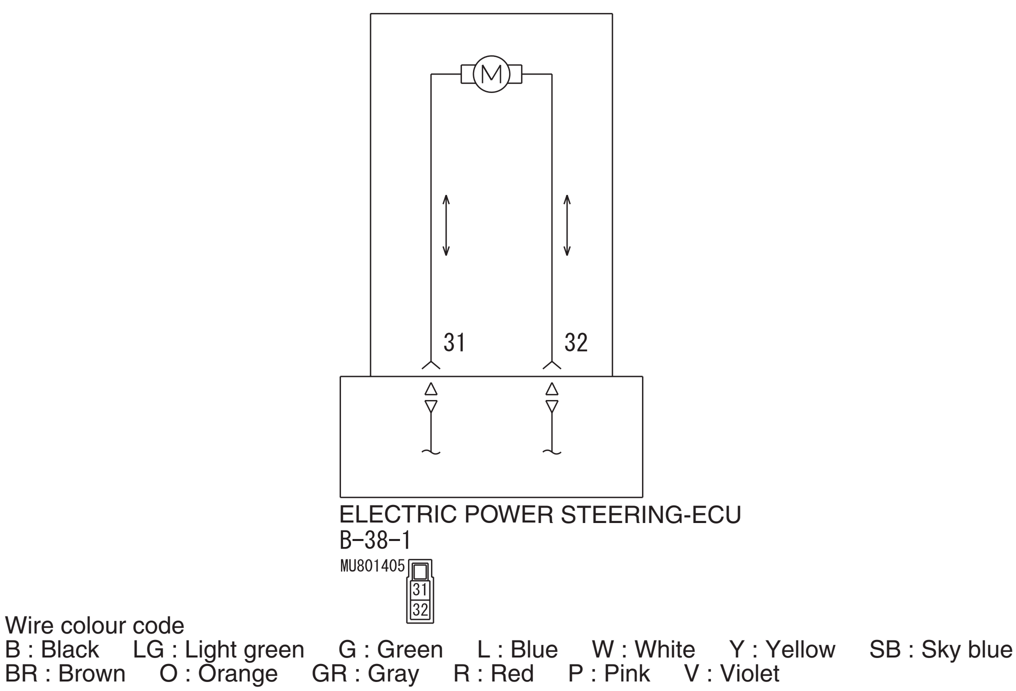
**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

## Code No.C1534 Under real current of motor

**⚠ CAUTION**

- **If the electric power steering-ECU sets diagnosis code No.C1534, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**Motor Circuit**




W3N37X004A

## DIAGNOSIS CODE SET CONDITIONS

- The motor current is less than the lower limit of the assist permission current stored in the microcomputer, but assist torque is produced. Then the microcomputer determines that there is a problem in the motor current.

### Criteria for judging malfunction

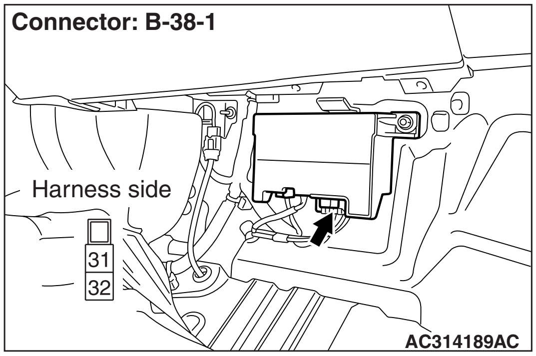
- Actual measurement value of the motor current (absolute value) is 1 A or less and assist torque (absolute value) is more than 0.3 N·m

## PROBABLE CAUSES

- Defective harness wire(s) or connector(s)
- Malfunction of the electric power steering-ECU
- Motor malfunction

## DIAGNOSTIC PROCEDURE

### STEP 1. Check the electric power steering-ECU connector B-38-1.




- B-38-1 electric power steering-ECU connector

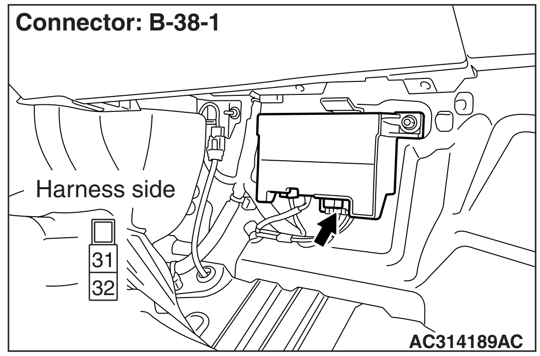
Check the connectors above for improper engagement, terminal damage or terminal drawn in the connector case.

**Q: Is the check result normal?**

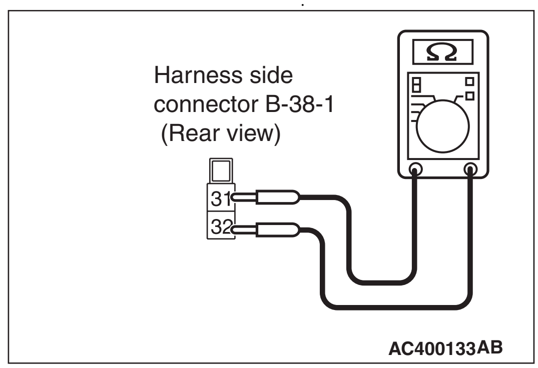
**YES :** Go to Step 2.

**NO :** Repair the connector(s) or terminal(s).

### STEP 2. Check the motor wires of the steering gear and linkage assembly wiring harness for open circuit.




Disconnect electric power steering-ECU connector B-38-1 and measure the resistance.




Measure the resistance between electric power steering-ECU connector B-38-1 terminals 31 and 32.

**OK: Continuity exists (2 Ω or less)**

**Q: Is the check result normal?**

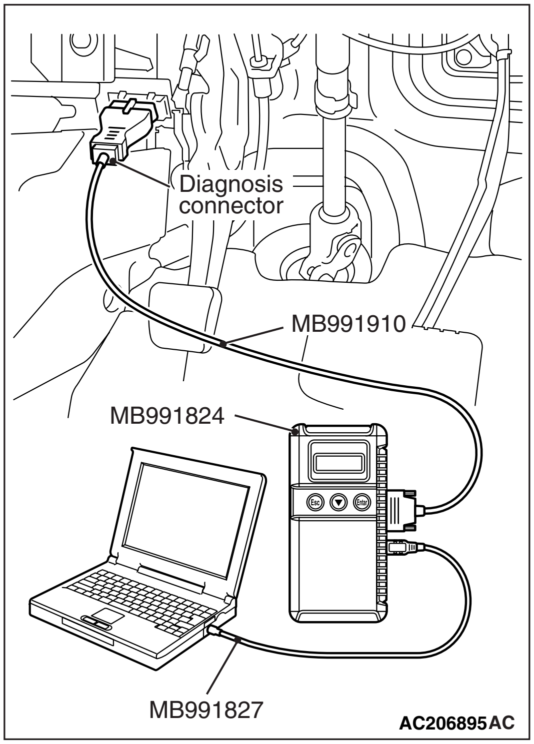
**YES :** Go to Step 3.

**NO :** Repair the harness wire and connector, or replace the steering gear and linkage assembly (Refer to P.37-96).

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**STEP 3. Check whether the diagnosis code is reset.**

⚠ **CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine and move the steering wheel to the right and left.
(6) Check if the diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.
(8) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1534 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

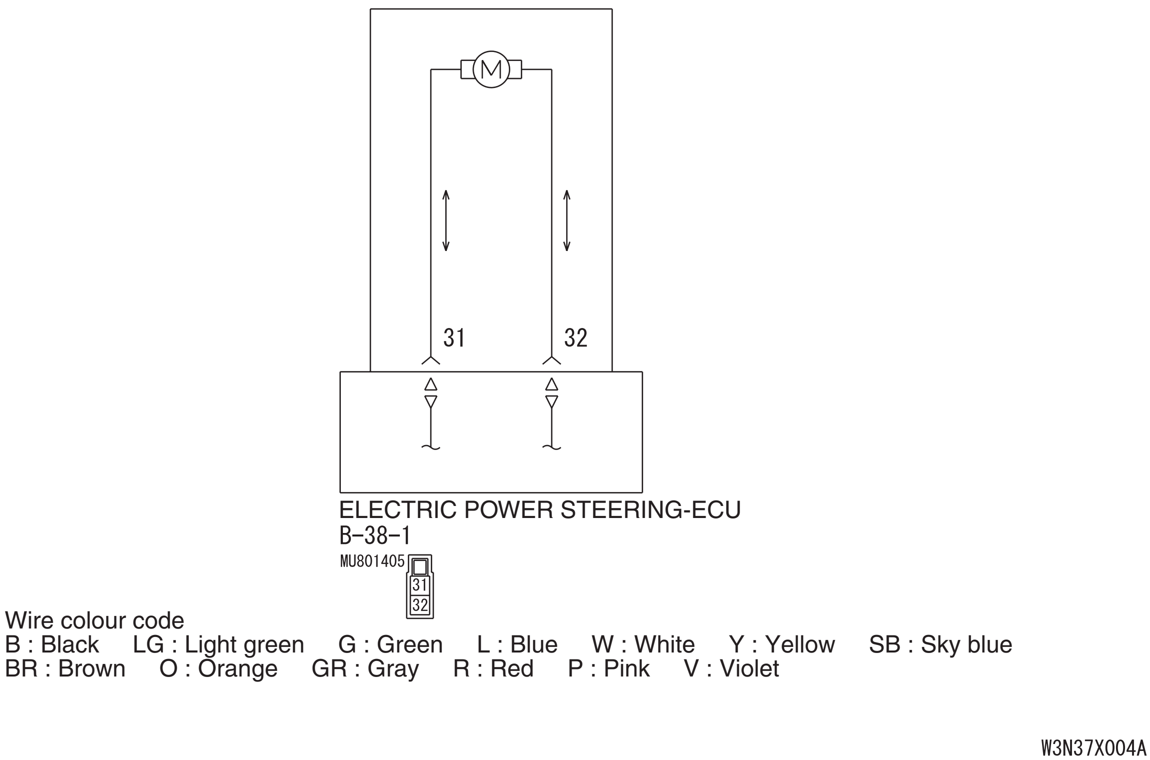
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### Code No.C1542 Fail-safe relay stuck off

**⚠ CAUTION**

- **If the electric power steering-ECU sets diagnosis code No.C1542, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**Motor Circuit**




## DIAGNOSIS CODE SET CONDITIONS

- Although the fail-safe relay (power relay) is turned on, the system is not energised and the microcomputer determines that the relay contact is open.
- The fail-safe relay (power relay) is not turned on and the microcomputer determines that the relay contact is open.

**Criteria for judging malfunction**

- Power supply voltage is less than 8 V and the difference between the ignition voltage and the power supply voltage is more than 2.5 V when the fail-safe relay is off.

## PROBABLE CAUSES

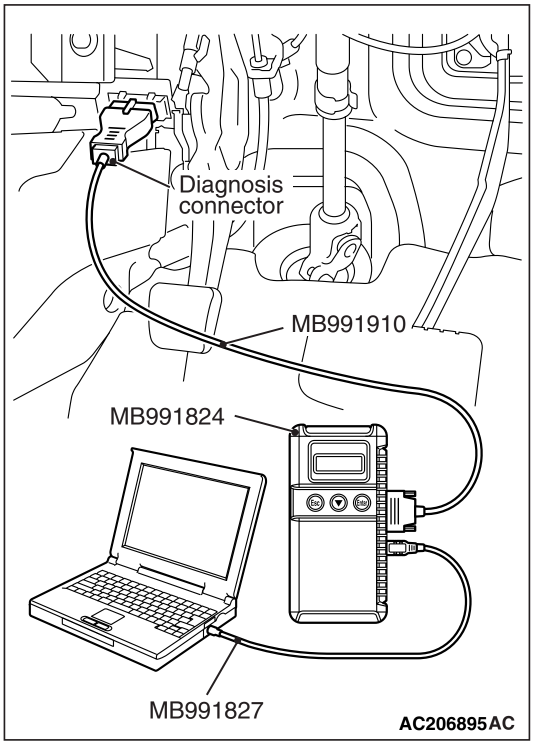
- Defective wire(s) or connector(s) in the power supply circuit to the electric power steering-ECU
- Malfunction of the electric power steering-ECU

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## DIAGNOSTIC PROCEDURE

### STEP 1. M.U.T.-III diagnosis code

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

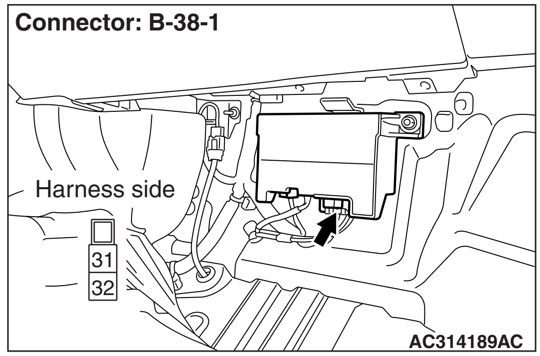
Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and check the diagnosis code.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

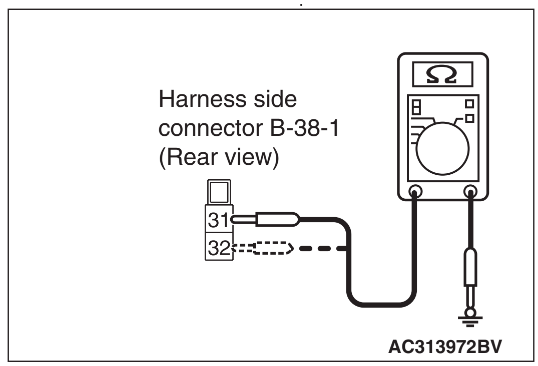
**Q: Are diagnosis codes C1542 and C1531 set simultaneously?**

**YES :** Go to Step 2.
**NO :** Go to Step 4.

### STEP 2. Check the motor wires of the steering gear and linkage assembly wiring harness for short to earth.




Disconnect electric power steering-ECU connector B-38-1 and measure the resistance.




Measure the resistance between electric power steering-ECU connector B-38-1 terminal 31 and body earth.

- Measure the resistance between electric power steering-ECU connector B-38-1 terminal 32 and body earth.

**OK: Open circuit or more than 300 Ω**

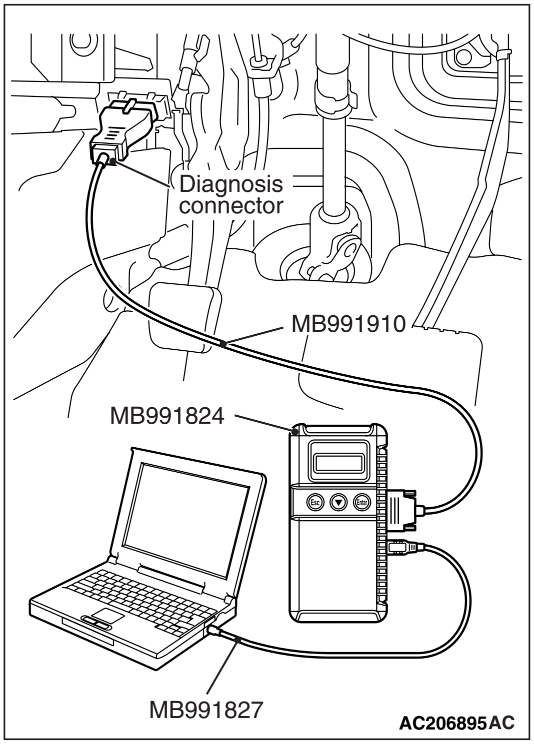
**Q: Is the check result normal?**

**YES :** Go to Step 3.
**NO :** Replace the steering gear and linkage assembly (Refer to P.37-96).

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**STEP 3. Check whether the diagnosis code is reset.**

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

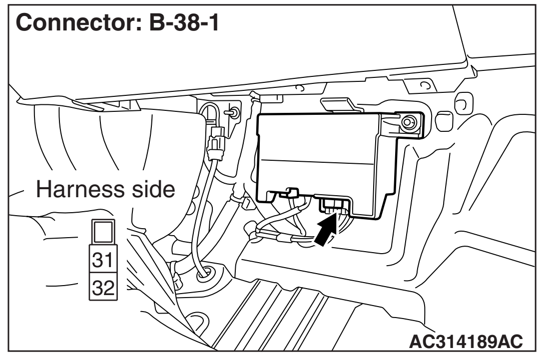
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and check the diagnosis code.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Are diagnosis codes C1542 and C1531 set?**

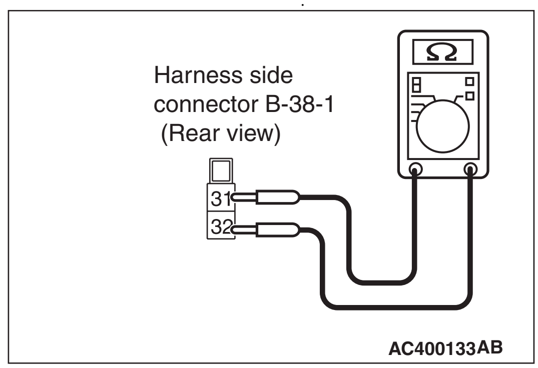
**YES : .** Replace the electric power steering-ECU (Refer to P.37-102).

**NO : .** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

**STEP 4. Check the motor wires of the steering gear and linkage assembly wiring harness for open circuit.**




Disconnect electric power steering-ECU connector B-38-1 and measure the resistance.




Measure the resistance between electric power steering-ECU connector B-38-1 terminals 31 and 32

**OK: Continuity exists (2 Ω or less)**

**Q: Is the check result normal?**

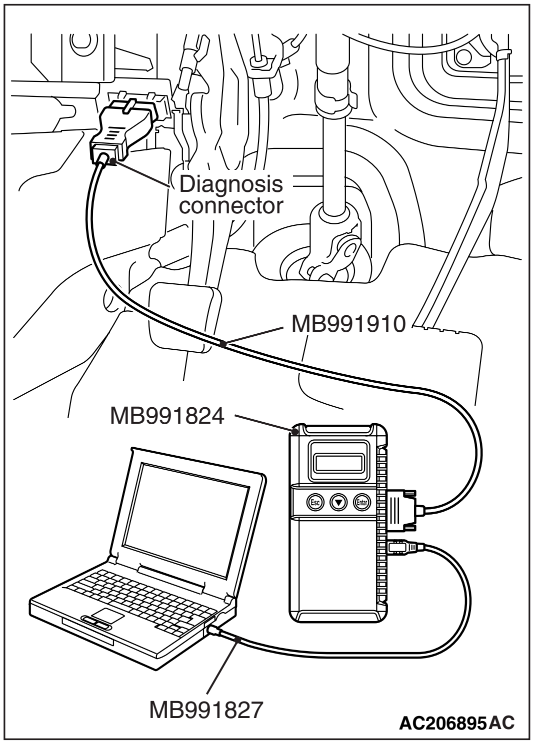
**YES :** Go to Step 5.

**NO :** Repair the harness wire and connector, or replace the steering gear box and linkage assembly (Refer to P.37-96).

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**STEP 5. Check whether the diagnosis code is reset.**

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Check if the diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.
(8) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1542 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).

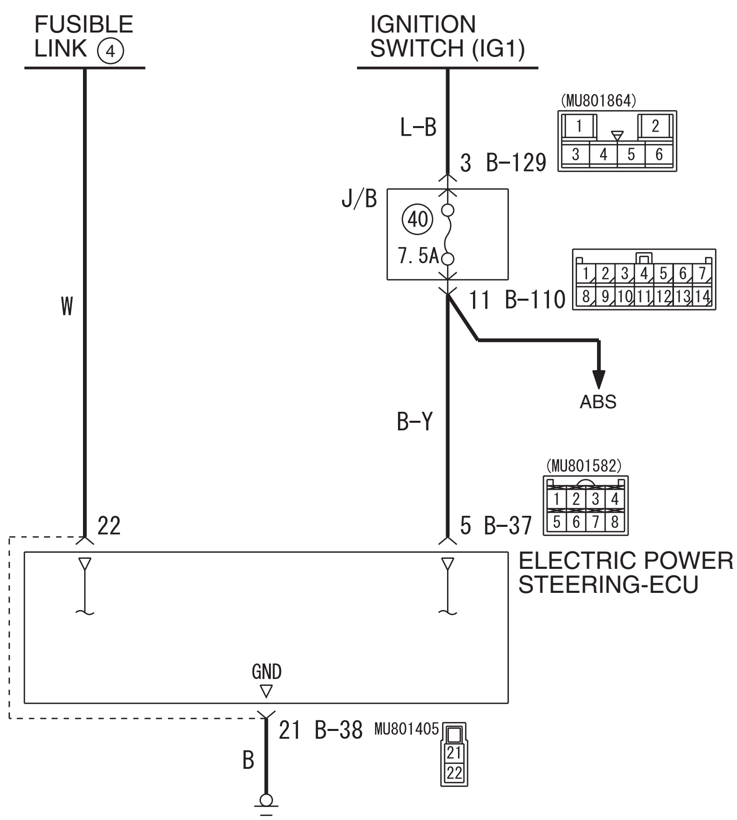
**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

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## Code No.C1860 Power supply voltage abnormality (high voltage)

**⚠ CAUTION**
- **If the electric power steering-ECU sets diagnosis code No.C1860, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**Power Supply and Earth Circuit**




Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple

W5N37X001A

## DIAGNOSIS CODE SET CONDITIONS

- The power supply voltage is more than a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the power supply system.

**Criteria for judging malfunction**
- Power supply voltage is more than 17.22 V

## PROBABLE CAUSES

- Defective battery
- Charging system failed
- Malfunction of the electric power steering-ECU

## DIAGNOSTIC PROCEDURE

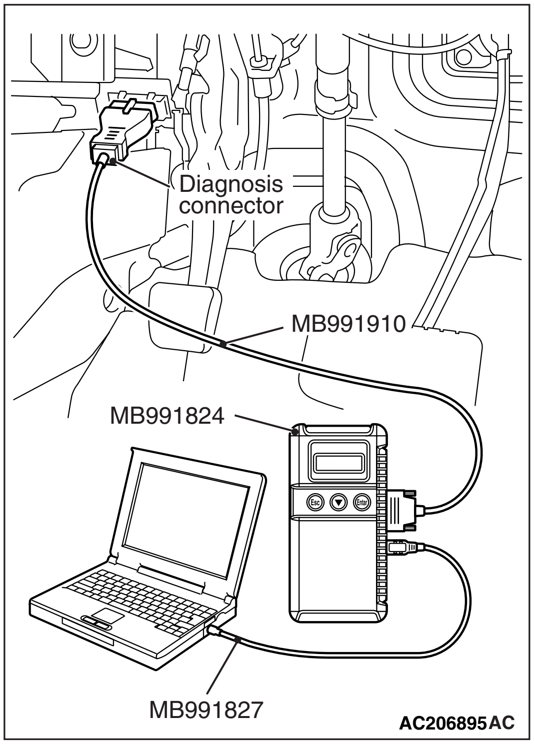
**STEP 1. Check the battery voltage.**
Start the engine and measure the battery voltage.

**Q: Does the voltage measure 16 V or less?**
**YES :** Go to Step 2.
**NO :** Check the charging system and repair if necessary (Refer to GROUP 16, On-vehicle Service – Regulated Voltage Test P.16-9).

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**STEP 2. Check whether the diagnosis code is reset.**

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and check the diagnosis code.
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1860 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

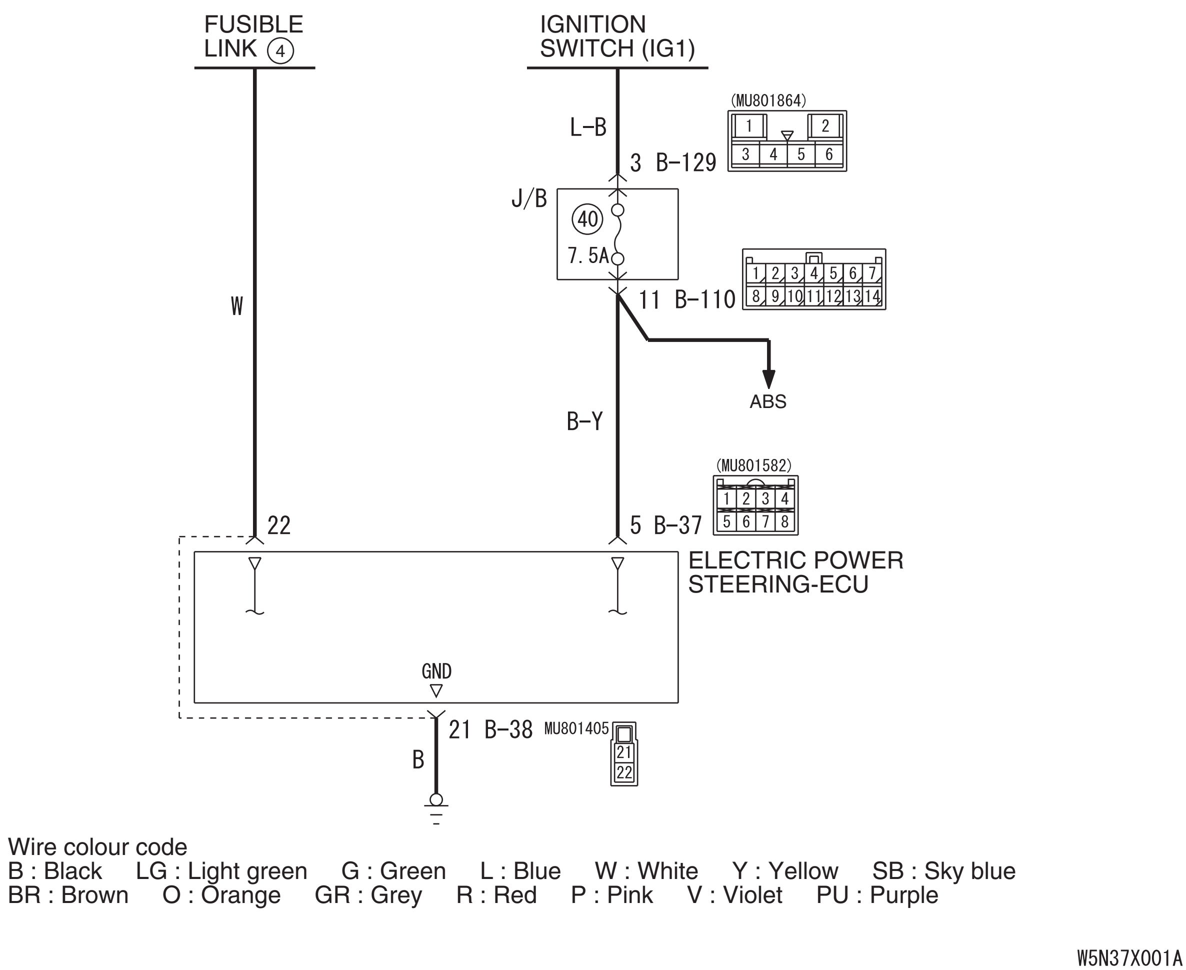
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## Code No.C1861 Power supply voltage abnormality (low voltage)

**⚠ CAUTION**

- **If the electric power steering-ECU sets diagnosis code No.C1861, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

Power Supply and Earth Circuit




## DIAGNOSIS CODE SET CONDITIONS

- The power supply voltage is less than a predetermined voltage stored in the microcomputer, and the microcomputer determines that there is a problem in the power supply system.

**Criteria for judging malfunction**

- Power supply voltage is less than 9 V

## PROBABLE CAUSES

- Defective battery
- Charging system failed
- Malfunction of the electric power steering-ECU
- Damaged harness wires and connectors

## DIAGNOSTIC PROCEDURE

**STEP 1. Check the battery voltage.**

Start the engine and measure the battery voltage.

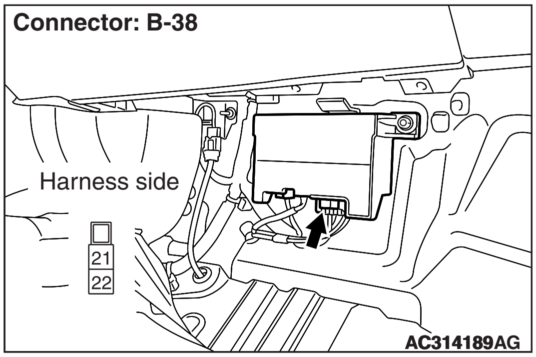
**Q: Does the voltage measure 10 V or more?**

**YES :** Go to Step 2.

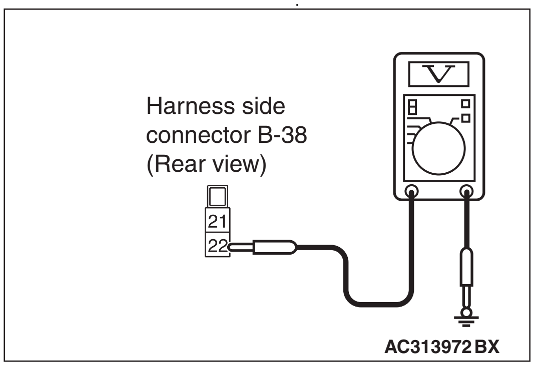
**NO :** Check the battery and the charging system and repair if necessary (Refer to GROUP 54A, Battery – Battery Test P.54A-5 or GROUP 16, On-vehicle Service – Regulated Voltage Test P.16-9).

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**STEP 2. Check the voltage in the power supply line.**




Disconnect connector B-38 and measure the voltage.




Measure the voltage between B-38 terminal 22 and body earth.

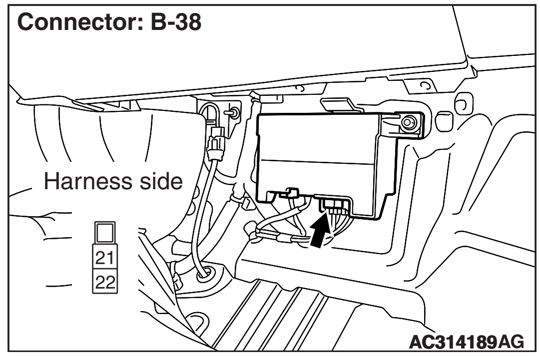
**OK: System voltage**

**Q: Is the measurement value normal?**

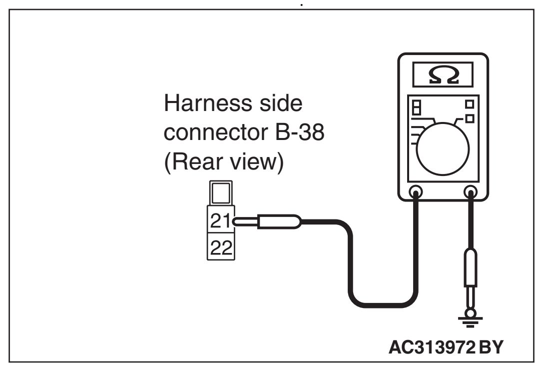
**YES :** Go to Step 3.

**NO :** Check the wiring harness wires and connectors between fusible link No.4 and electric power steering-ECU connector B-38 and repair if necessary.

**STEP 3. Check the resistance in the earth line.**




Disconnect connector B-38 and measure the resistance.




Measure the resistance between B-38 terminal 21 and body earth.

**OK: Continuity exists (2 Ω or less)**

**Q: Is the measurement value normal?**

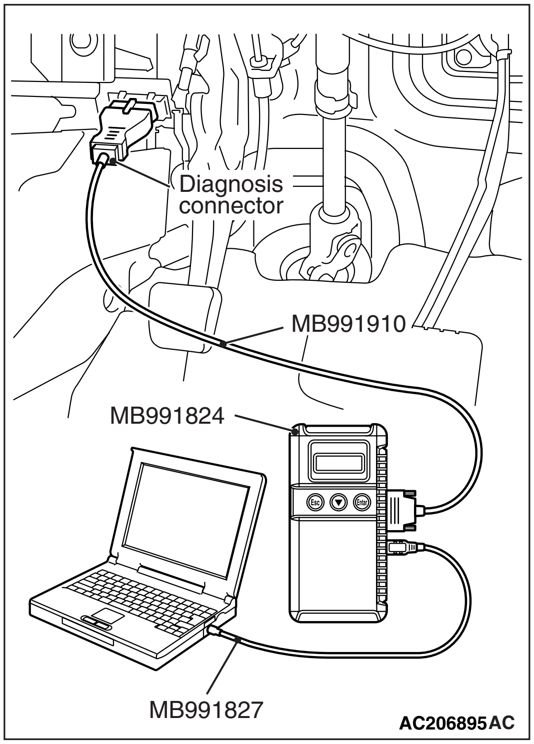
**YES :** Go to Step 4.

**NO :** Check the wiring harness wires and connectors between body earth and electric power steering-ECU connector B-38 and repair if necessary.

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**STEP 4. Check whether the diagnosis code is reset.**

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and check the diagnosis code.
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Disconnect M.U.T.-III.

**Q: Is diagnosis code C1861 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

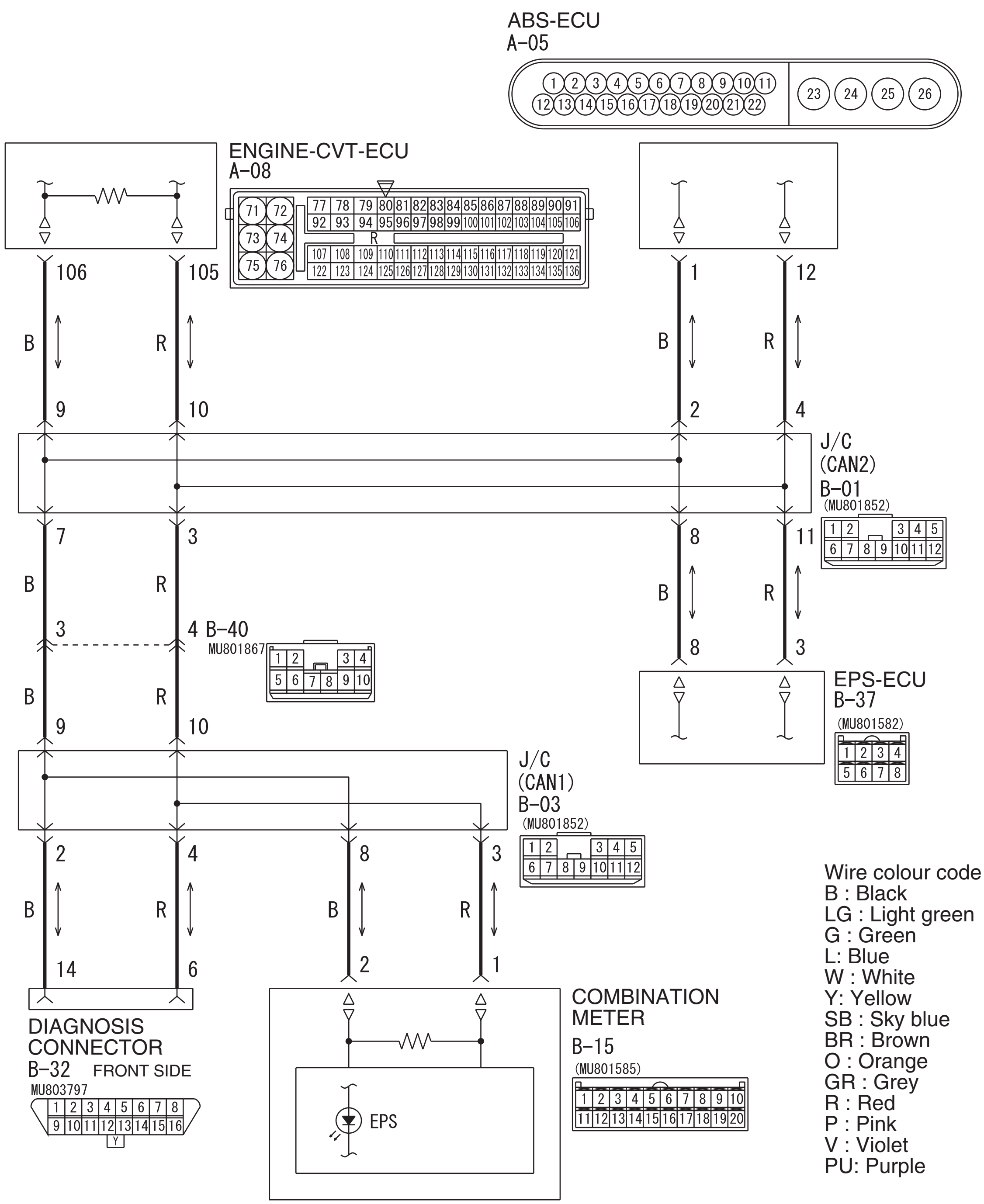
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## Code No.U1073 Bus off

**⚠ CAUTION**

- **If the electric power steering-ECU sets diagnosis code No.U1073, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**CAN Communication Circuit**




W5N37X000A

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## TROUBLE JUDGMENT

When the electric power steering-ECU is bus off, it is memorised.

## COMMENTS ON TROUBLE SYMPTOM

Harness wire(s), connector(s) or the electric power steering-ECU may be defective.

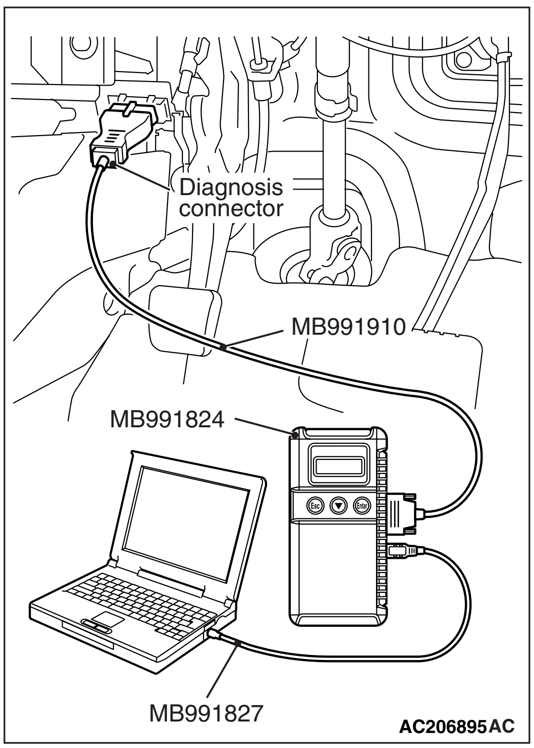
## PROBABLE CAUSES

- Defective wire(s) or connector(s) in the CAN bus lines
- Malfunction of the electric power steering-ECU

## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III CAN bus diagnostics

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

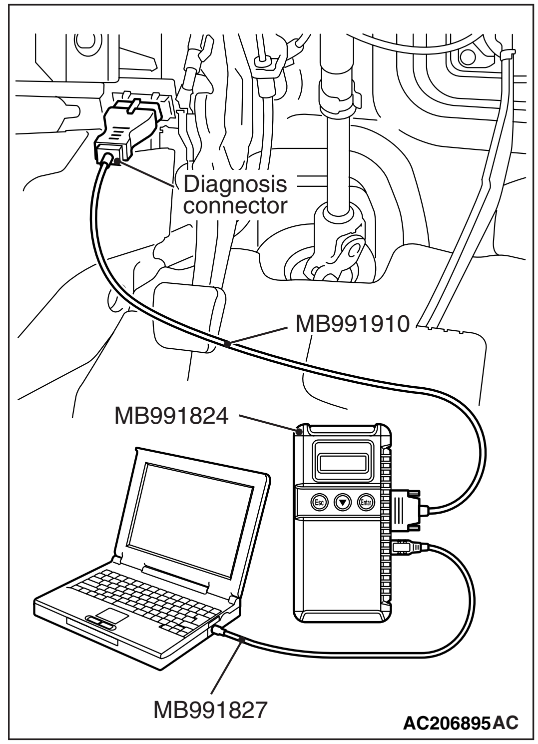
(1) Connect M.U.T.-III to the 16-pin diagnosis connector.
(2) Turn the ignition switch to the "ON" position.
(3) Diagnose the CAN bus line.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the check result normal?**

**YES : .** Go to Step 2.
**NO : .** Repair the CAN bus line (Refer to GROUP 54D, Diagnosis P.54D-13).

### STEP 2. Check whether the diagnosis code is reset.

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Recheck whether diagnosis code U1073 is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.
(8) Disconnect M.U.T.-III.

**Q: Is diagnosis code U1073 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).
**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

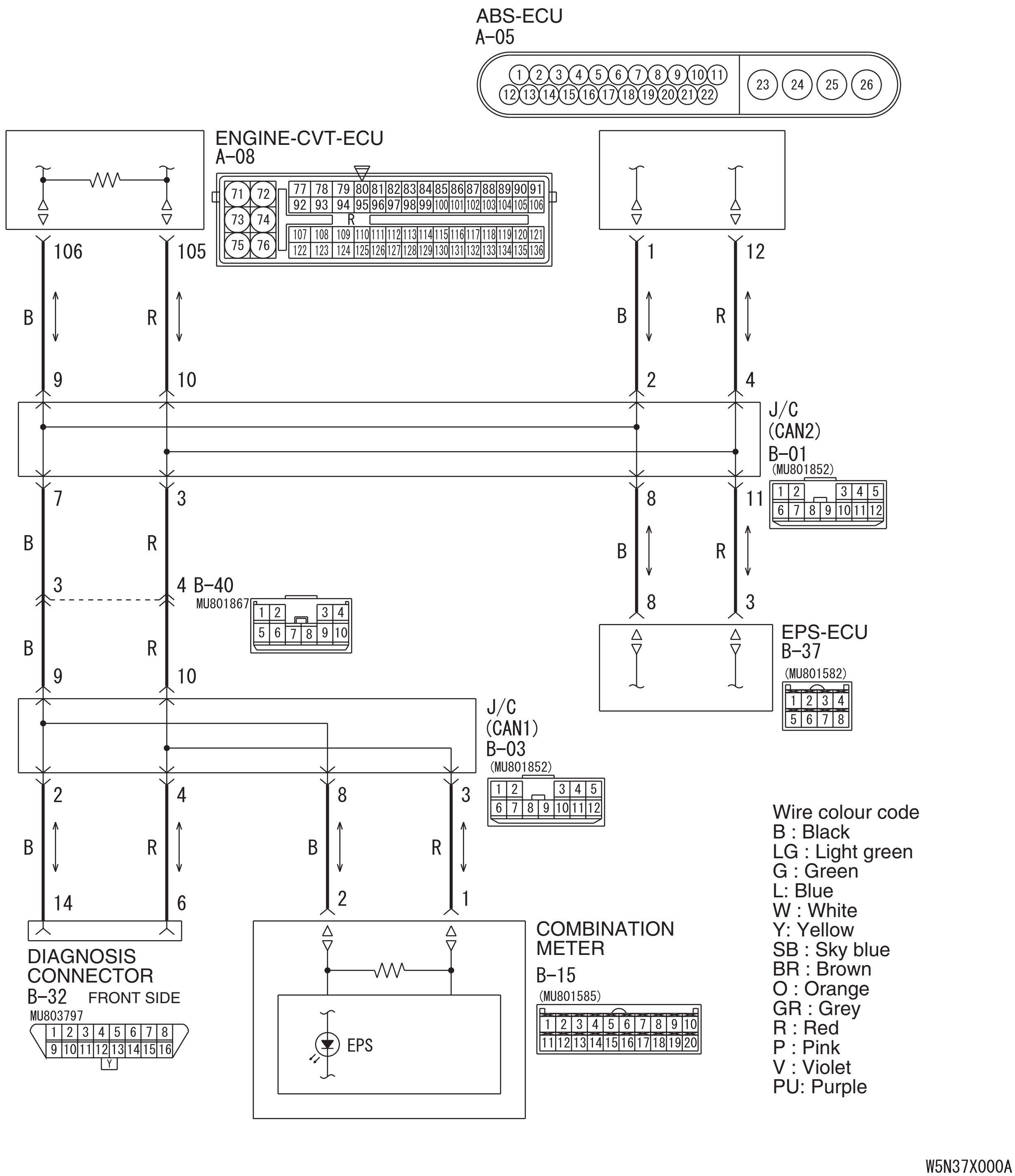
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## Code No.U1100 Engine-related time-out

**⚠ CAUTION**

- **If more than three minutes elapse after the ignition switch is turned ON without starting engine, the electric power steering-ECU may set diagnosis codes U1100 and U1102 as the M.U.T.-III shows a diagnosis code status as stored.**
- **If the electric power steering-ECU sets diagnosis code No.U1100, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**CAN Communication Circuit**



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## TROUBLE JUDGMENT

The electric power steering-ECU receives engine speed data (crankshaft angle sensor data) from the engine-CVT-ECU through the CAN bus lines. If the ECU cannot receive the engine speed data (crankshaft angle sensor data) from the engine-CVT-ECU for 60 seconds, diagnosis code U1100 will be set.

## COMMENTS ON TROUBLE SYMPTOM

**The M.U.T.-III shows a diagnosis code status as active**

- Defective harness wire(s) or connector(s) in the CAN bus lines between the engine-CVT-ECU and the electric power steering-ECU, or the power supply to these ECUs, or the ECUs themselves are defective.

**The M.U.T.-III shows a diagnosis code status as stored**

- Carry out diagnosis by referring to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to treat past trouble P.00-13. Carry out diagnosis with particular emphasis on connector(s) or wiring harness in the CAN bus lines between the engine-CVT-ECU and the electric power steering-ECU, and the power supply to the engine-CVT-ECU.

*NOTE: As the M.U.T.-III shows a diagnosis code status as stored, you can not find it by the M.U.T.-III CAN bus diagnostics even if there is any failure in CAN bus lines. In this case, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points-How to Cope with Intermittent Malfunction P.00-13 and check the CAN bus lines. You can narrow down the possible cause of the trouble by referring to the diagnosis code, which is set regarding the CAN communication-linked ECUs (Refer to GROUP 54D, CAN Bus Line Diagnostic Flow P.54D-7).*

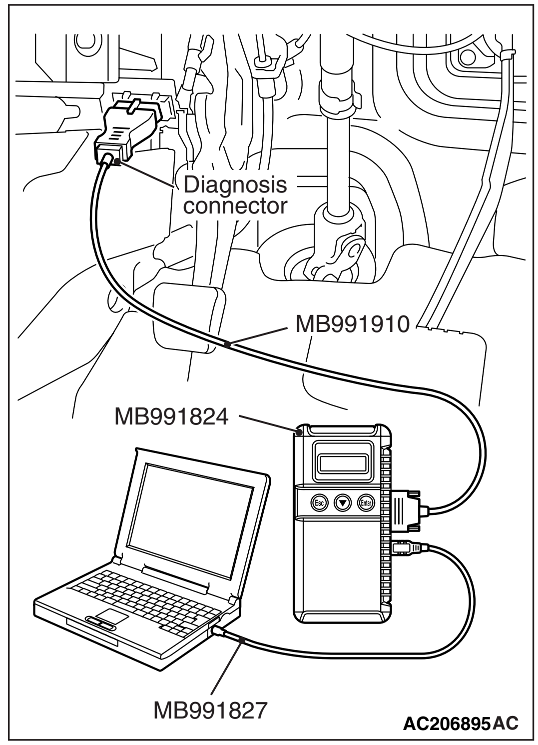
## PROBABLE CAUSES

- Defective harness wire(s) or connector(s)
- Malfunction of the engine-CVT-ECU
- Malfunction of the electric power steering-ECU

## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III CAN bus diagnostics

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

(1) Connect M.U.T.-III to the 16-pin diagnosis connector.
(2) Turn the ignition switch to the "ON" position.
(3) Diagnose the CAN bus line.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

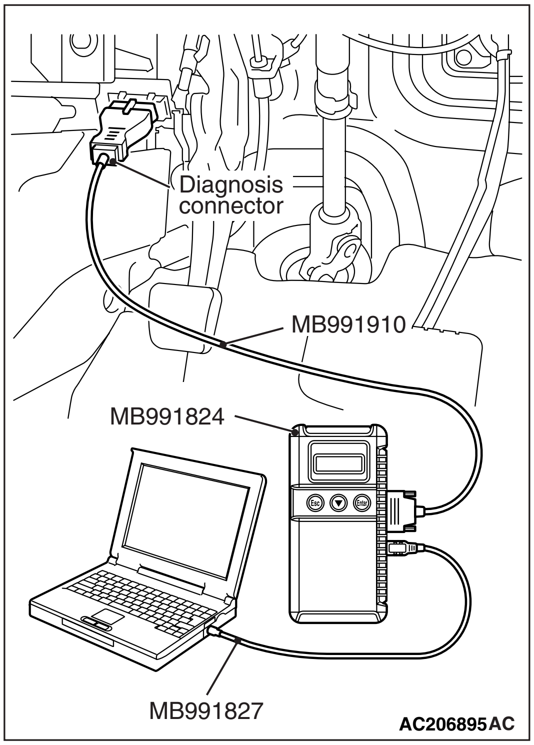
**Q: Is the check result normal?**

**YES :** Go to Step 2.
**NO :** Repair the CAN bus line (Refer to GROUP 54D, CAN bus line Diagnostic flow P.54D-13). Then go to Step 2.

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### STEP 2. M.U.T.-III other system diagnosis code

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Check that an engine control system diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the diagnosis code set?**

**YES : .** Diagnose the engine control system (Refer to GROUP 13A, Troubleshooting P.13A-20 <4A9>, GROUP 13B, Troubleshooting P.13B-18 <4G1>).

**NO : .** Go to Step 3.

### STEP 3. M.U.T.-III data list

Set the M.U.T.-III to the data reading mode, and check the data list item (when the engine starts).

- Item 12: Engine speed
- Item 87: Tachometer (Refer to GROUP 54A, Combination meter – Data list reference table P.54A-59)

**OK: The reading on the tachometer nearly match the indication on M.U.T.-III.**

**Q: Is the engine speed input normal?**

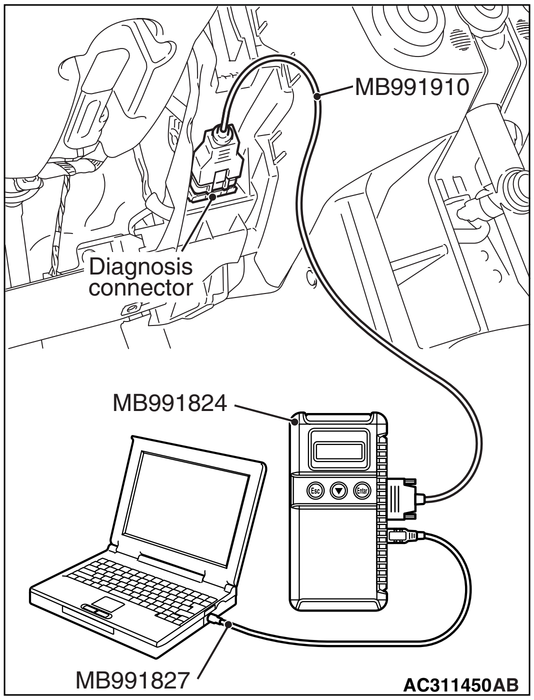
**YES :** Go to Step 4.

**NO :** Replace the engine-CVT-ECU (Refer to GROUP 13A, Engine-CVT-ECU P.13A-372).

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### STEP 4. Check whether the diagnosis code is reset

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine and wait for at least 60 seconds.
(6) Recheck whether diagnosis code U1100 is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.
(8) Disconnect M.U.T.-III.

**Q: Is diagnosis code U1100 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).

**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

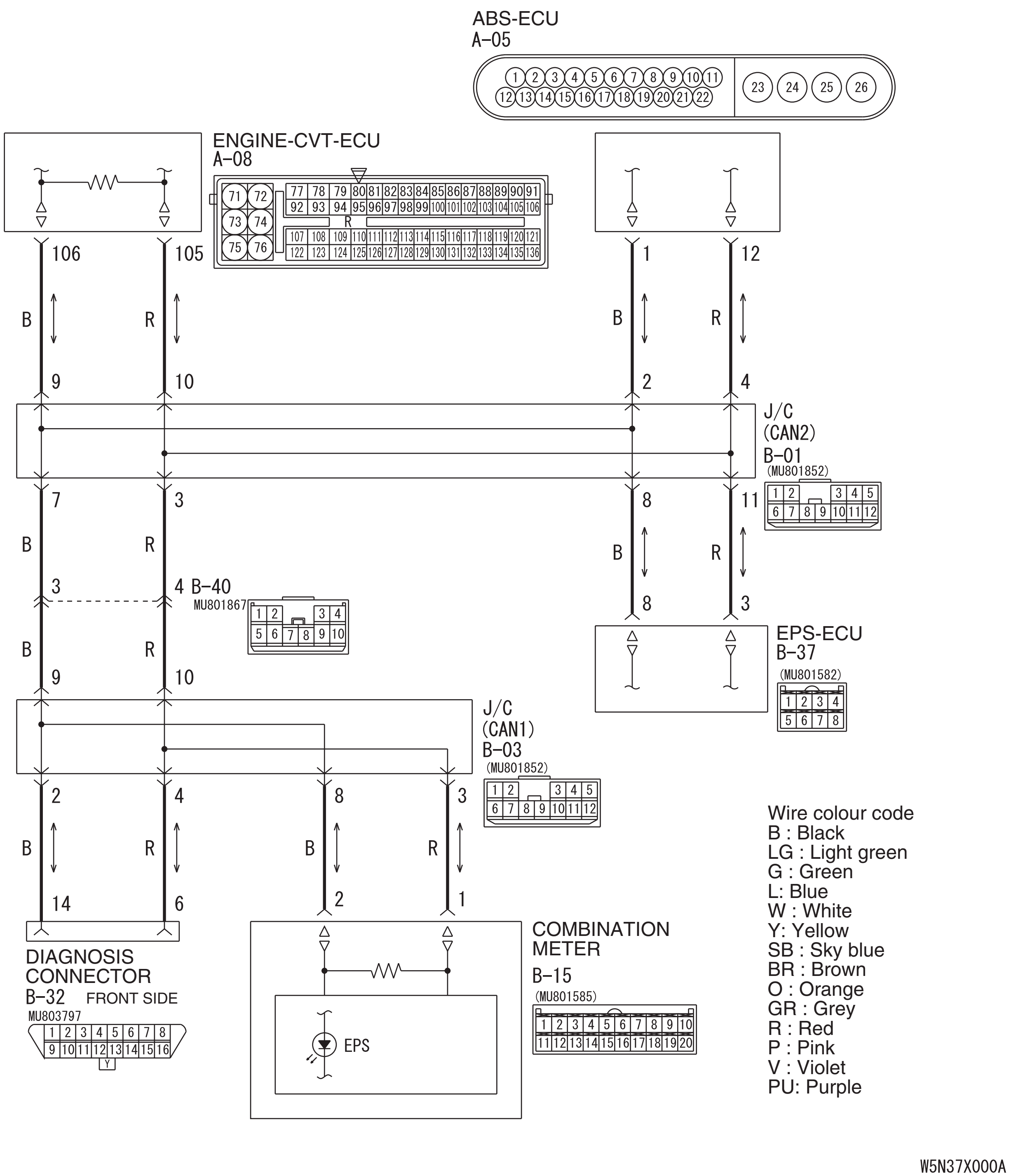
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## Code No.U1102 CAN communication time-out with ABS-ECU

⚠ **CAUTION**

- **If more than three minutes elapse after the ignition switch is turned ON without starting engine, the electric power steering-ECU may set diagnosis codes U1100 and U1102 as the M.U.T.-III shows a diagnosis code status as stored.**
- **If the electric power steering-ECU sets diagnosis code No.U1102, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**CAN Communication Circuit**



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## TROUBLE JUDGMENT

The electric power steering-ECU receives vehicle speed data (wheel speed sensor data) from the ABS-ECU through the CAN bus lines. If the electric power steering-ECU cannot receive the vehicle speed data (wheel speed sensor data) from the ABS-ECU for 60 seconds, diagnosis code U1102 will be set.

## COMMENTS ON TROUBLE SYMPTOM

**The M.U.T.-III shows a diagnosis code status as active**

- Defective harness wire(s) or connector(s) in the CAN bus lines between the ABS-ECU and the electric power steering-ECU, or the power supply to these ECUs, or the ECUs themselves are defective.

**The M.U.T.-III shows a diagnosis code status as stored**

- Carry out diagnosis by referring to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to treat past trouble P.00-13. Carry out diagnosis with particular emphasis on connector(s) or wiring harness in the CAN bus lines between the ABS-ECU and the electric power steering-ECU, and the power supply to the ABS-ECU.

*NOTE: For a The M.U.T.-III shows a diagnosis code status as stored, you can not find it by the M.U.T.-III CAN bus diagnostics even if there is any failure in CAN bus lines. In this case, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points-How to Cope with Intermittent Malfunction P.00-13 and check the CAN bus lines. You can narrow down the possible cause of the trouble by referring to the diagnosis code, which is set regarding the CAN communication-linked ECUs (Refer to GROUP 54D, CAN Bus Line Diagnostic Flow P.54D-7).*

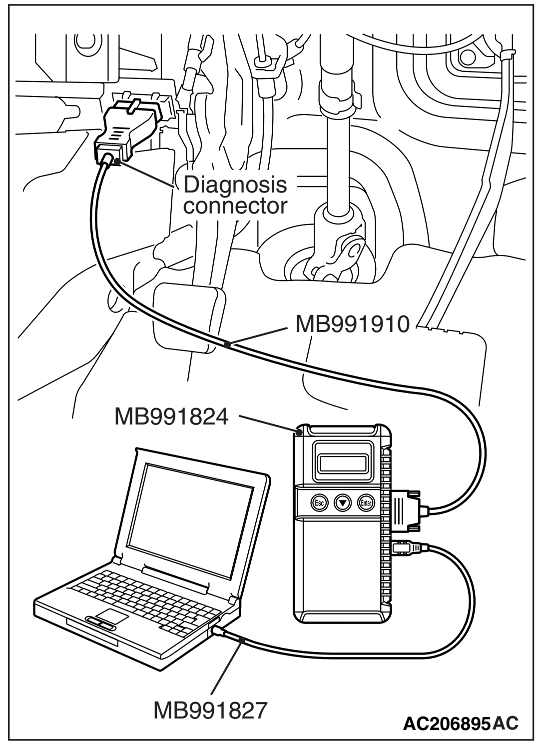
## PROBABLE CAUSES

- Defective harness wire(s) or connector(s)
- Malfunction of the ABS-ECU
- Malfunction of the electric power steering-ECU

## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III CAN bus diagnostics

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

(1) Connect M.U.T.-III to the 16-pin diagnosis connector.
(2) Turn the ignition switch to the "ON" position.
(3) Diagnose the CAN bus line.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

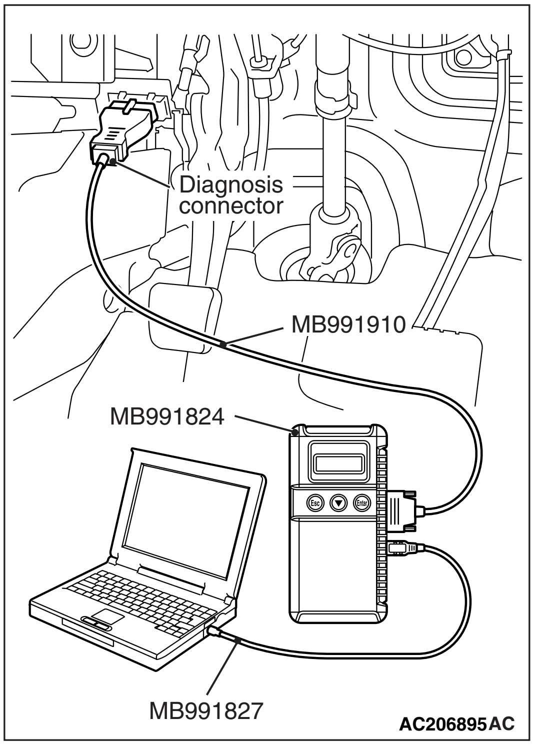
**Q: Is the check result normal?**

**YES :** Go to Step 2.
**NO :** Repair the CAN bus line (Refer to GROUP 54D, Diagnosis P.54D-13). Then go to Step 2.

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### STEP 2. M.U.T.-III other system diagnosis code

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

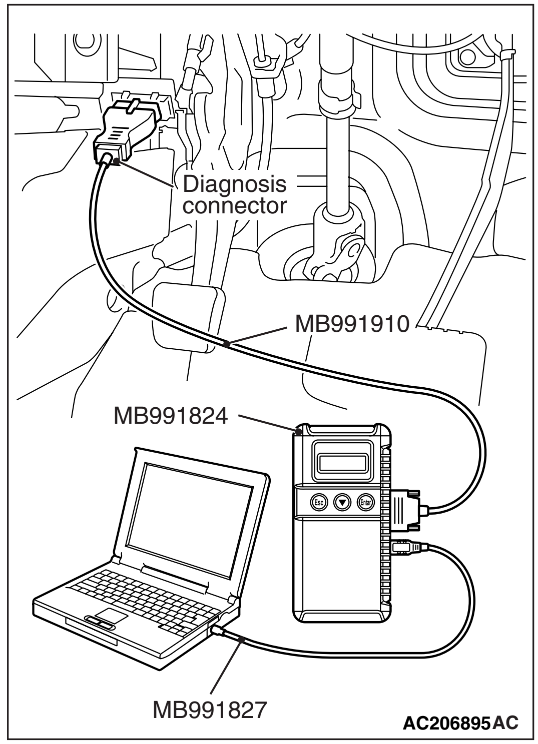
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Check that an ABS system diagnosis code is set.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the diagnosis code set?**

**YES :** Diagnose the ABS system (Refer to GROUP 35B, Troubleshooting P.35B-7 ).
**NO :** Go to Step 3.

### STEP 3. Check whether the diagnosis code is reset

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine and wait for at least 60 seconds.
(6) Recheck whether diagnosis code U1102 is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.

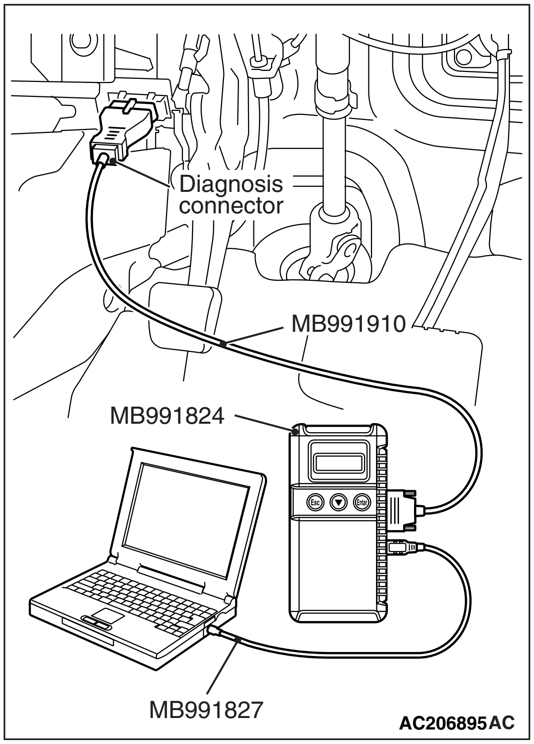
**Q: Is diagnosis code U1102 set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102). Then go to Step 4.
**NO :** Go to Step 4.

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**STEP 4. Check whether the diagnosis code is reset**

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine, and check the diagnosis code.
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Disconnect M.U.T.-III.

**Q: Is diagnosis code U1102 set?**

**YES :** Replace the hydraulic unit (Refer to GROUP 35B, Hydraulic Unit P.35B-78).

**NO :** This diagnosis is complete.

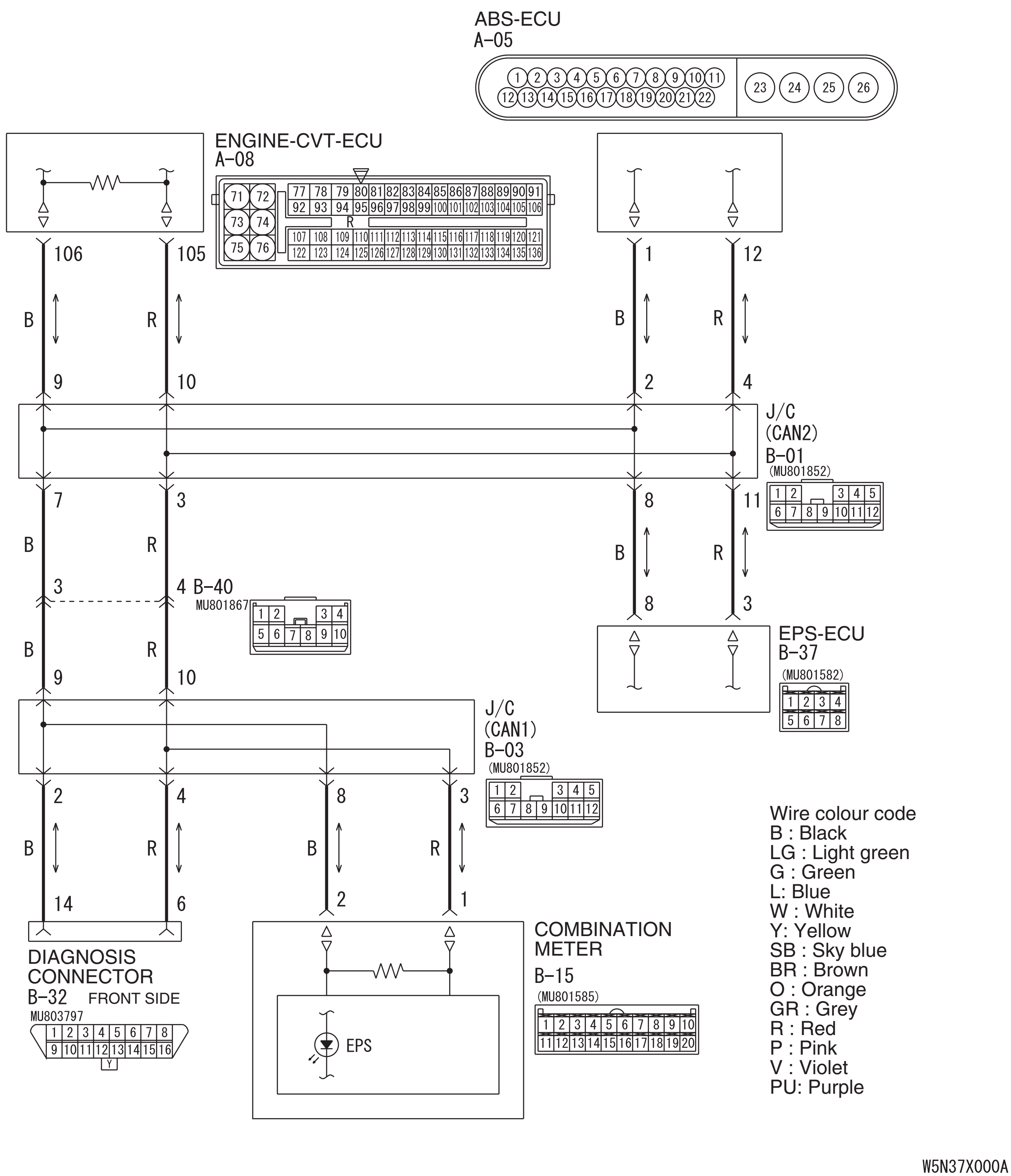
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## Code No.U1120 Engine-related failure information

**⚠ CAUTION**

- **If the electric power steering-ECU sets diagnosis code No.U1120, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**CAN Communication Circuit**



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## TROUBLE JUDGMENT

The electric power steering-ECU receives engine speed data (crankshaft angle sensor data) from the engine-CVT-ECU through the CAN bus lines. If the ECU receives engine speed data (crankshaft angle sensor data) containing failure information 100 times, diagnosis code U1120 will be set.

## COMMENTS ON TROUBLE SYMPTOM

**The M.U.T.-III shows a diagnosis code status as active**

- The crankshaft angle sensor system (of the engine-CVT-ECU), or the engine-CVT-ECU or the electric power steering-ECU may be defective.

**The M.U.T.-III shows a diagnosis code status as stored**

- Carry out diagnosis by referring to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to treat past trouble P.00-13. Carry out diagnosis with particular emphasis on connector(s) or wiring harness in the CAN bus lines between the engine-CVT-ECU and the electric power steering-ECU.

*NOTE: For a The M.U.T.-III shows a diagnosis code status as stored, you can not find it by the M.U.T.-III CAN bus diagnostics even if there is any failure in CAN bus lines. In this case, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points-How to Cope with Intermittent Malfunction P.00-13 and check the CAN bus lines. You can narrow down the possible cause of the trouble by referring to the diagnosis code, which is set regarding the CAN communication-linked ECUs (Refer to GROUP 54D, CAN Bus Line Diagnostic Flow P.54D-7).*

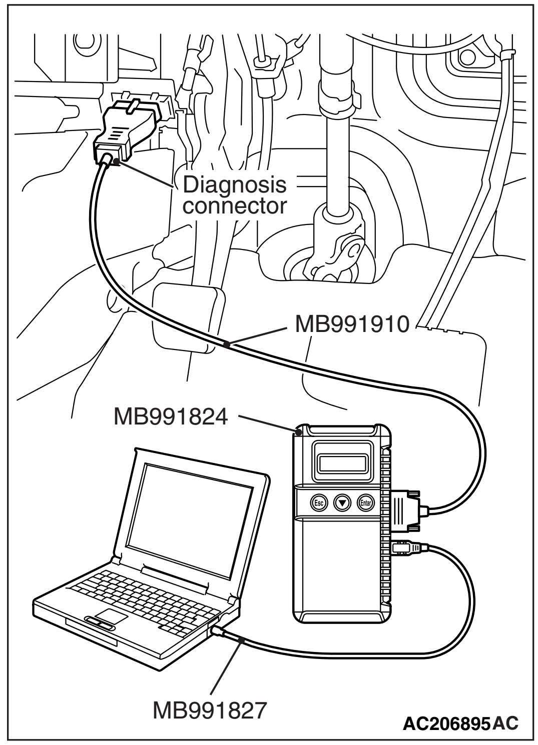
## PROBABLE CAUSES

- Defective harness wire(s) or connector(s)
- Malfunction of the engine-CVT-ECU
- Malfunction of the electric power steering-ECU

## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III CAN bus diagnostics

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

(1) Connect M.U.T.-III to the 16-pin diagnosis connector.
(2) Turn the ignition switch to the "ON" position.
(3) Diagnose the CAN bus line.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

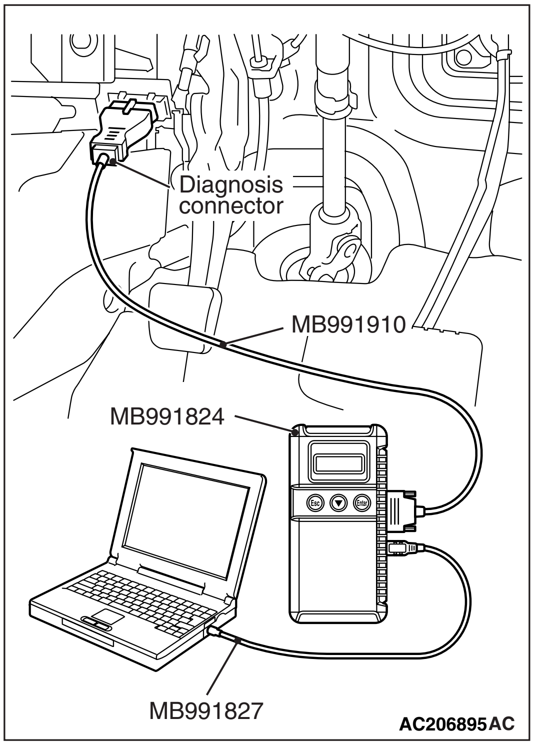
**Q: Is the check result normal?**

**YES :** Go to Step 2.
**NO :** Repair the CAN bus line (Refer to GROUP 54D, CAN bus line Diagnostic flow P.54D-13).

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### STEP 2. M.U.T.-III other system diagnosis code

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Check that an engine control system diagnosis code is set.
(7) Turn the ignition switch to the "LOCK" (OFF) position.

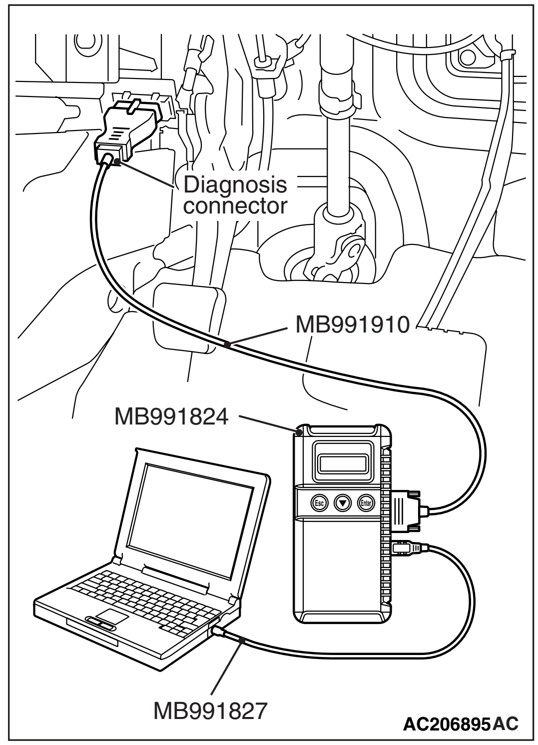
**Q: Is an engine control system diagnosis code set?**

**YES :** Diagnose the engine control system (Refer to GROUP 13A, Troubleshooting P.13A-20 <4A9>, GROUP 13B, TroubleshootingP.13B-18 <4G1>).

**NO :** Go to Step 3.

### STEP 3. M.U.T.-III other system diagnosis code

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Start the engine.
(6) Check if a diagnosis code, which relates to CAN communication-linked systems below, is set.
  - Meter

  U1120: Diagnosis code indicating engine control-related failure information
(7) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the diagnosis code set?**

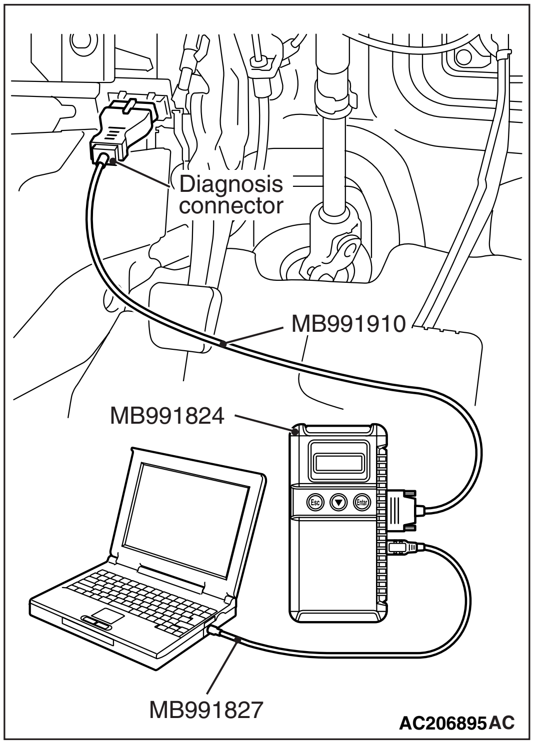
**YES :** Go to Step 4.

**NO :** Go to Step 5.

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### STEP 4. Check whether the diagnosis code is reset

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Recheck whether diagnosis code U1120 is set.
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Disconnect M.U.T.-III.

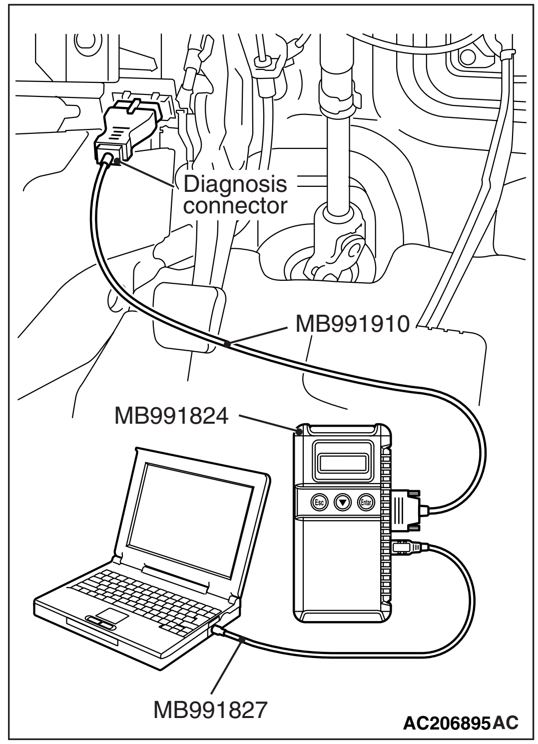
**Q: Is the diagnosis code set?**

**YES :** Replace the engine-CVT-ECU (Refer to GROUP 13A, Engine-CVT-ECU P.13A-372).

**NO :** A poor connection, open circuit or other intermittent malfunction is present between the engine-CVT-ECU and the crankshaft angle sensor. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

### STEP 5. Check whether the diagnosis code is reset

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Recheck whether diagnosis code U1120 is set.
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Disconnect M.U.T.-III.

**Q: Is the diagnosis code set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102).

**NO :** A poor connection, open circuit or other intermittent malfunction is present between the engine-CVT-ECU and the crankshaft angle sensor. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

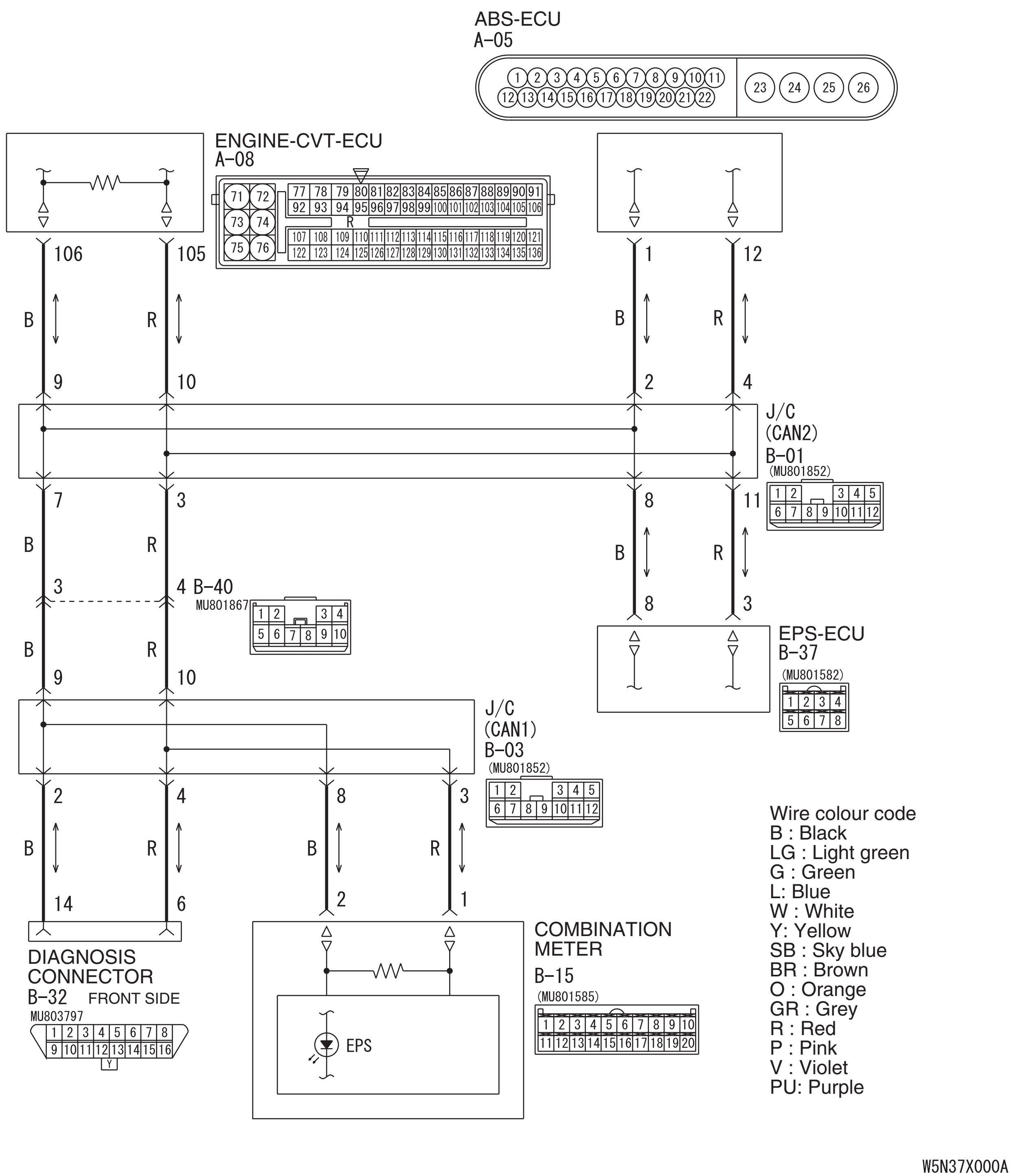
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## Code No.U1122 ABS-ECU failure information

⚠ **CAUTION**

- **If the electric power steering-ECU sets diagnosis code No.U1122, diagnose the CAN bus lines. If there is any fault in the CAN bus lines, an incorrect diagnosis code may be set.**
- **Whenever the ECU is replaced, ensure that the communication circuit is normal.**

**CAN Communication Circuit**



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## TROUBLE JUDGMENT

The electric power steering-ECU receives vehicle speed data (wheel speed sensor data) from the ABS-ECU through the CAN bus lines. If the ECU receives vehicle speed data (wheel speed sensor data) containing failure information twice, diagnosis code U1122 will be set.

## COMMENTS ON TROUBLE SYMPTOM

**The M.U.T.-III shows a diagnosis code status as active**

- The wheel speed sensor system (of the ABS-ECU), the ABS-ECU or the electric power steering-ECU may be defective.

**The M.U.T.-III shows a diagnosis code status as stored**

- Carry out diagnosis by referring to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to treat past trouble P.00-13. Carry out diagnosis with particular emphasis on connector(s) or wiring harness in the CAN bus lines between the ABS-ECU and the electric power steering-ECU.

*NOTE: For a The M.U.T.-III shows a diagnosis code status as stored, you can not find it by the M.U.T.-III CAN bus diagnostics even if there is any failure in CAN bus lines. In this case, refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points-How to Cope with Intermittent Malfunction P.00-13 and check the CAN bus lines. You can narrow down the possible cause of the trouble by referring to the diagnosis code, which is set regarding the CAN communication-linked ECUs (Refer to GROUP 54D, CAN Bus Line Diagnostic Flow P.54D-7).*

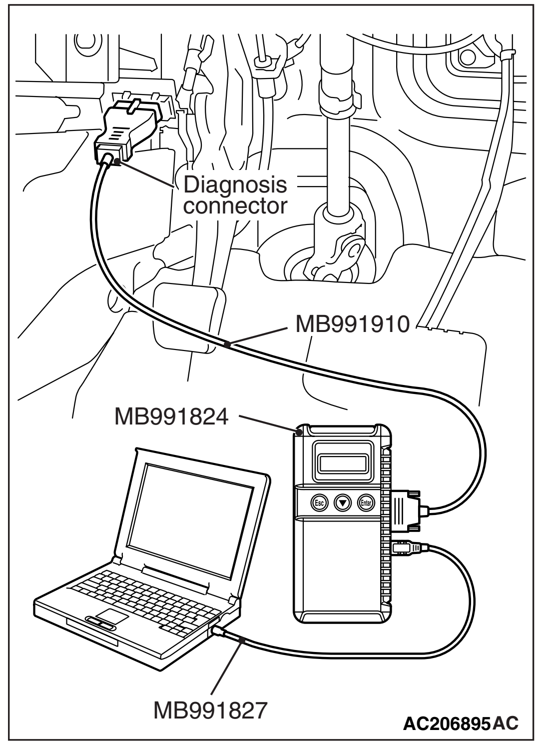
## PROBABLE CAUSES

- Defective harness wire(s) or connector(s)
- Malfunction of the ABS-ECU
- Malfunction of the electric power steering-ECU

## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III CAN bus diagnostics

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

(1) Connect M.U.T.-III to the 16-pin diagnosis connector.
(2) Turn the ignition switch to the "ON" position.
(3) Diagnose the CAN bus line.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

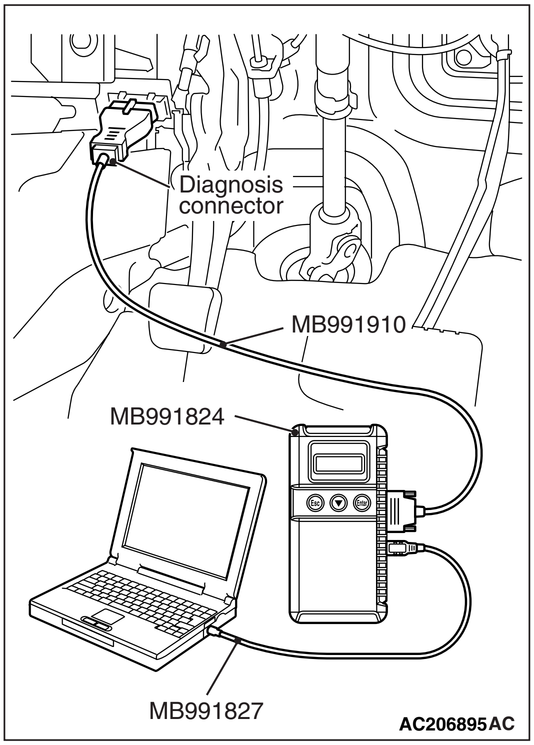
**Q: Is the check result normal?**

**YES :** Go to Step 2.
**NO :** Repair the CAN bus line (Refer to GROUP 54D, Diagnosis P.54D-13).

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### STEP 2. M.U.T.-III other system diagnosis code

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

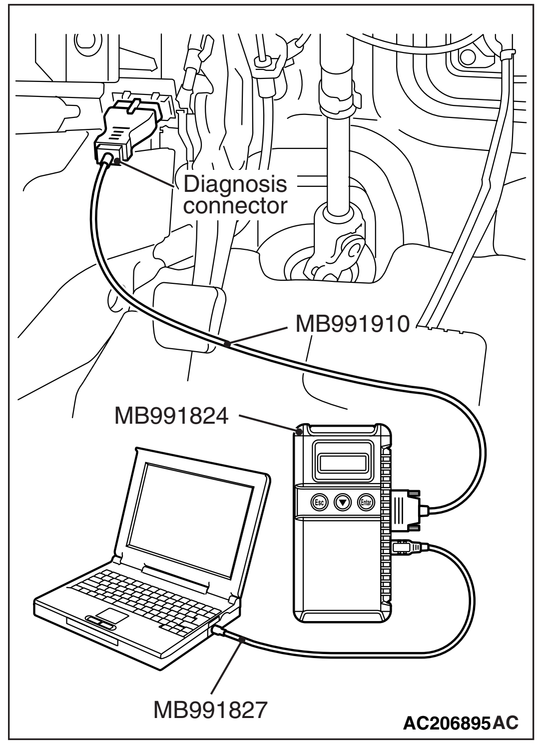
Check again if the diagnosis code is set.
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Check that an ABS system diagnosis code is set.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the diagnosis code set?**

**YES :** Diagnose the ABS system (Refer to GROUP 35B, Troubleshooting P.35B-7).
**NO :** Go to Step 3.

### STEP 3. Check whether the diagnosis code is reset

**⚠ CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.
(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Recheck whether diagnosis code U1122 is set.
(6) Turn the ignition switch to the "LOCK" (OFF) position.

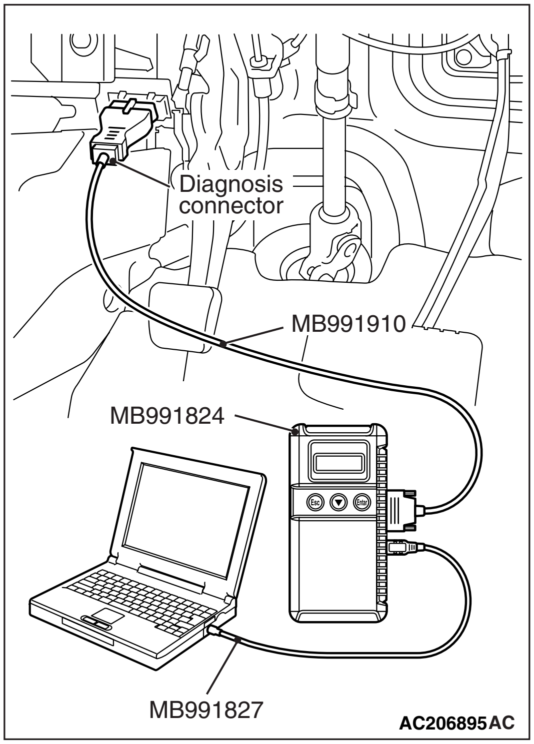
**Q: Is the diagnosis code set?**

**YES :** Replace the electric power steering-ECU (Refer to P.37-102). Then go to Step 4.
**NO :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

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**STEP 4. Check whether the diagnosis code is reset**

⚠ **CAUTION**




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

Check again if the diagnosis code is set.

(1) Turn the ignition switch to the "ON" position.
(2) Erase the diagnosis code.
(3) Turn the ignition switch to the "LOCK" (OFF) position.
(4) Turn the ignition switch to the "ON" position.
(5) Recheck whether diagnosis code U1122 is set.
(6) Turn the ignition switch to the "LOCK" (OFF) position.
(7) Disconnect M.U.T.-III.

**Q: Is the diagnosis code set?**

**YES :** Replace the hydraulic unit (Refer to GROUP 35B, Hydraulic Unit P.35B-78).
**NO :** This diagnosis is complete.

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## TROUBLE SYMPTOM CHART

M1372007600344

⚠ CAUTION

**During diagnosis, a diagnosis code associated with other system may be set when the ignition switch is turned on with connector(s) disconnected. On completion, confirm all systems for diagnosis code(s). If diagnosis code(s) are set, erase them all.**

| Trouble symptom | Inspection procedure | Reference pages or actions |
|---|---|---|
| The M.U.T.-III cannot communicate with the electric power steering system. | 1 <CAN communication system check> | P.37-72 |
| | 2 <ECU power supply circuit system check> | P.37-74 |
| Although the electric power steering warning lamp illuminates, the diagnosis code is not stored. | 3 | P.37-78 |
| The steering has become heavy, but the electric power steering warning lamp does not illuminate (This is normal, because the electric power steering is limiting assist operation).<br>*NOTE: If the vehicle is driven under heavy load (e.g. consecutively turning the steering to full lock or severe cornering), the electric power steering motor drive circuit will become hot. In this case, the electric power steering system will limit assist operation by decreasing the motor current to avoid damage. In this case, the steering will become heavy, but the electric power steering warning lamp does not illuminate. If the circuit temperature reduces after a while, the assist operation will return to the normal level.* | – | Reproduce the steering operation, which your customer did. Check the M.U.T.-III data list item No.07 (assist limit current), and confirm that the electric power steering system limited the assist operation (Refer to P.37-84). Note that this is not a failure. |
| When the ignition switch is turned on, the system does not perform the bulb check for the electric power steering warning lamp (The electric power steering warning lamp does not illuminate until the engine is started).<br>*NOTE: The ignition switch is turned to the ON position (within approximately 0.3 second) again immediately after it is turned to the LOCK (OFF) position, the electric power steering warning lamp does not illuminate.* | – | Replace the meter assembly (Refer to GROUP 54A, Combination Meter P.54A-68). |

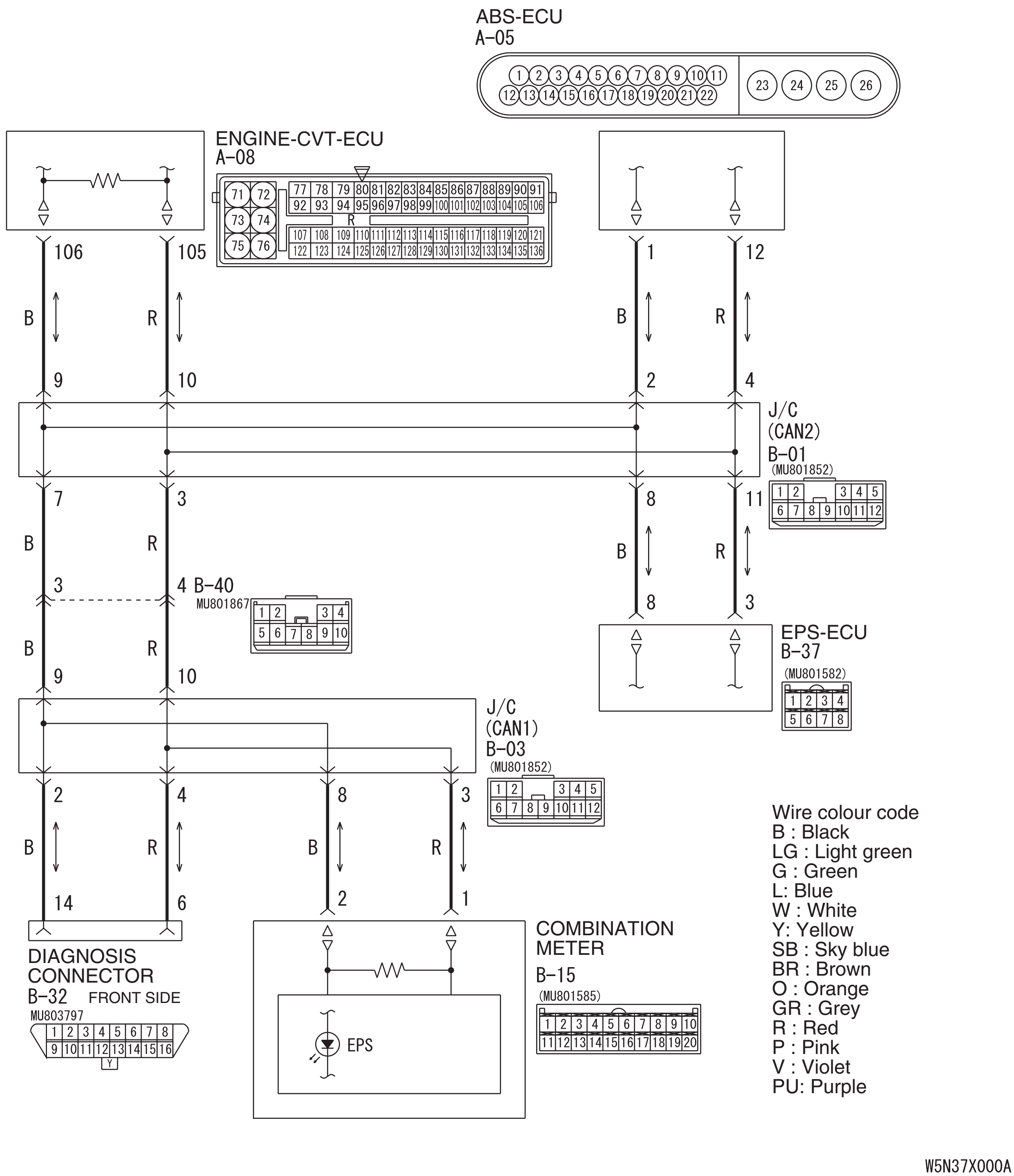
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## SYMPTOM PROCEDURES

**Inspection Procedure 1: M.U.T.-III cannot communicate with electric power steering system <CAN communication system check>.**

**CAN Communication Circuit**



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## COMMENTS ON TROUBLE SYMPTOM

If the M.U.T.-III cannot communicate with the electric power steering system, the CAN bus lines may be defective. If the electric power steering system does not operate (power assist is not available), the electric power steering-ECU or its power supply may be defective.

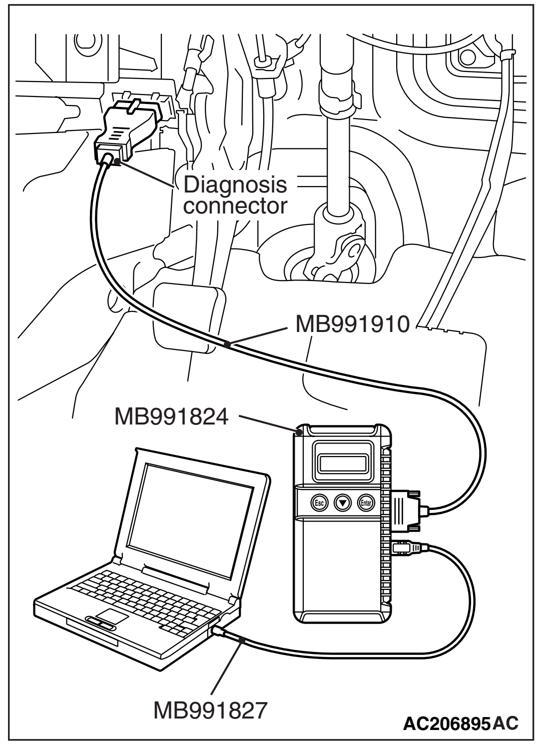
## PROBABLE CAUSES

- Defective harness wire(s) or connector(s)
- Malfunction of the electric power steering-ECU

## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III CAN bus diagnostics

⚠ CAUTION




**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

(1) Connect M.U.T.-III to the 16-pin diagnosis connector.
(2) Turn the ignition switch to the "ON" position.
(3) Diagnose the CAN bus line.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the check result normal?**

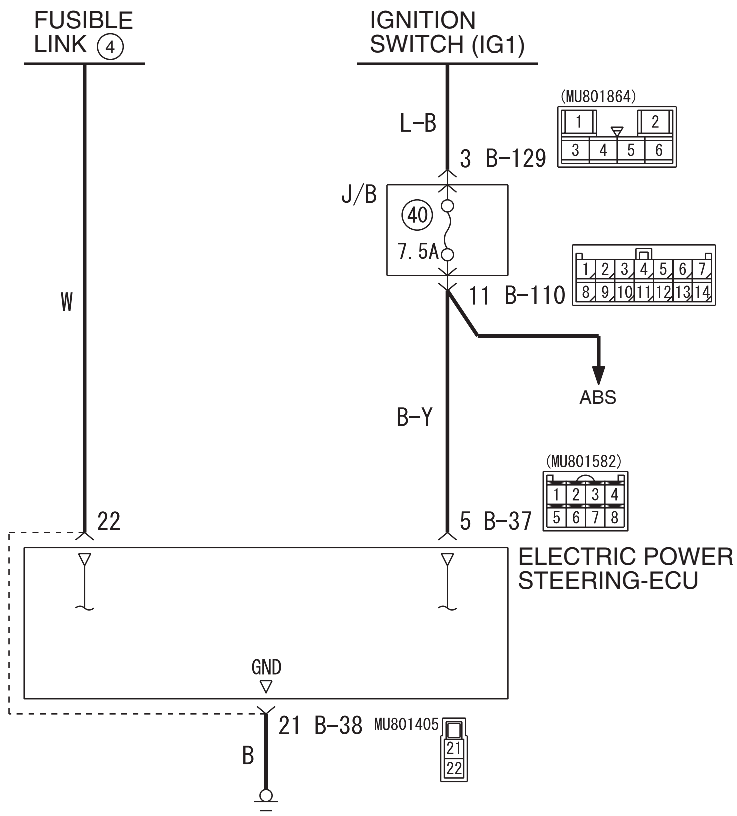
**YES :** Check the ECU power supply circuit system (Refer to P.37-78).

**NO :** Repair the CAN bus line (Refer to GROUP 54D, Diagnosis P.54D-13).

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**Inspection Procedure 2: M.U.T.-III cannot communicate with electric power steering system <ECU power supply circuit system check>.**

Power Supply and Earth Circuit




Wire colour code
B : Black LG : Light green G : Green L : Blue W : White Y : Yellow SB : Sky blue
BR : Brown O : Orange GR : Grey R : Red P : Pink V : Violet PU : Purple

W5N37X001A

## COMMENTS ON TROUBLE SYMPTOM

If the M.U.T.-III cannot communicate with the electric power steering system, the CAN bus lines may be defective. If the electric power steering system does not operate (power assist is not available), the electric power steering-ECU or its power supply may be defective.

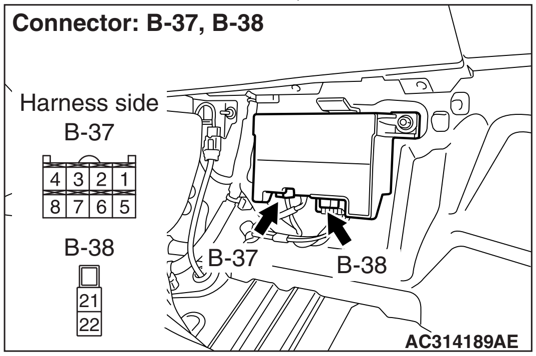
## PROBABLE CAUSES

- Defective harness wire(s) or connector(s)
- Malfunction of the electric power steering-ECU

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## DIAGNOSIS PROCEDURE

### STEP 1. Check the connectors and terminals.




Electric power steering-ECU connectors B-37 and B-38

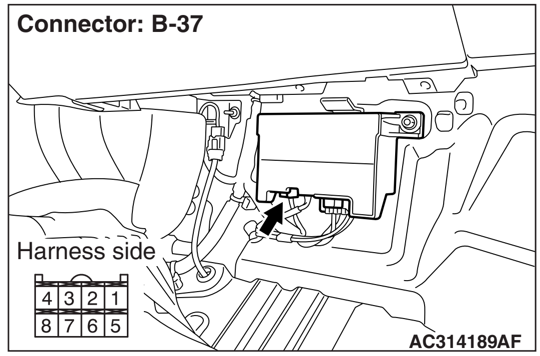
Check the connectors above for improper engagement, terminal damage or terminal drawn in the connector case.

**Q: Are the connectors and terminals in good condition?**

**YES :** Go to Step 2.

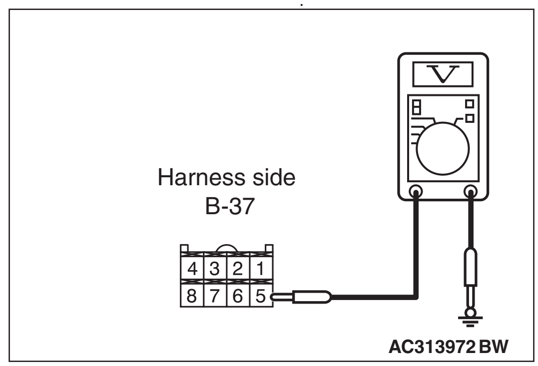
**NO :** Repair the connector(s) or terminal(s).

### STEP 2. Voltage measurement at electric power steering-ECU connector B-37.




Disconnect the connector, and measure at the wiring harness side.

- Ignition Switch: ON




Measure the voltage between electric power steering-ECU connector B-37 terminal No.5 and body earth

**OK: system voltage**

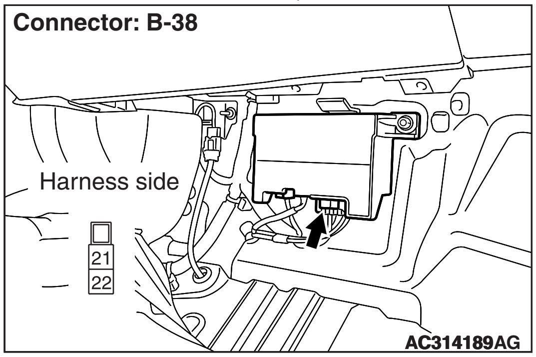
**Q: Is the check result normal?**

**YES :** Go to Step 3.

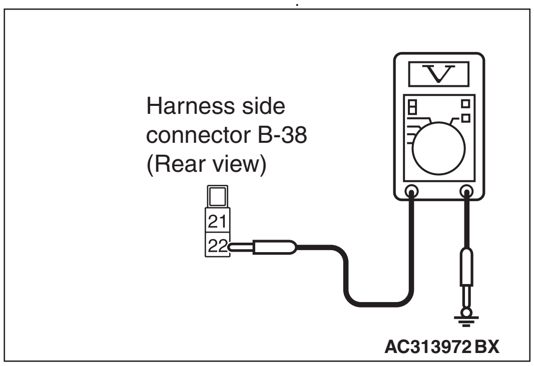
**NO :** Go to Step 5.

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**STEP 3. Voltage measurement at electric power steering-ECU connector B-38.**




Disconnect the connector, and measure at the wiring harness side.




Measure the voltage between electric power steering-ECU connector B-38 terminal No.22 and body earth

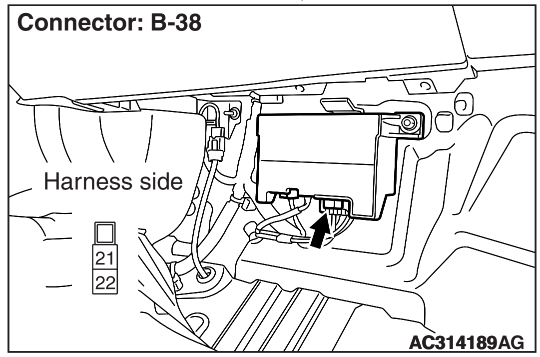
**OK: system voltage**

**Q: Is the check result normal?**

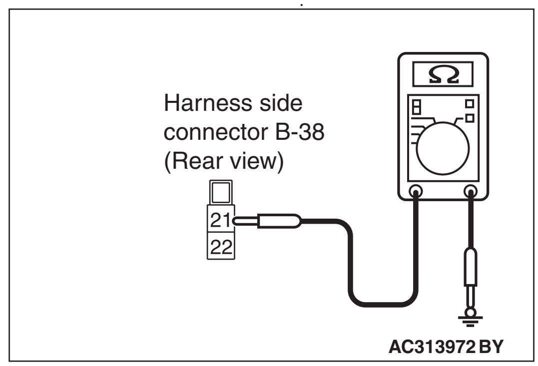
**YES :** Go to Step 4.

**NO :** Go to Step 6.

**STEP 4. Resistance measurement at electric power steering-ECU connector B-38.**




Disconnect the connector, and measure at the wiring harness side.




Measure the resistance between electric power steering-ECU connector B-38 terminal No.21 and body earth

**OK: Continuity exists (2 Ω or less)**

**Q: Is the check result normal?**

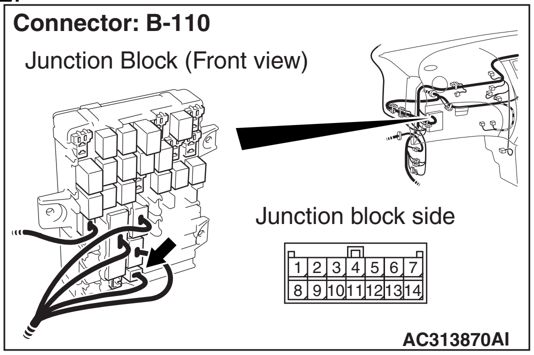
**YES :** Go to Step 8.

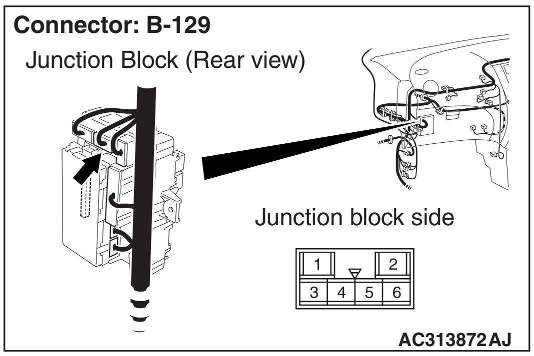
**NO :** Go to Step 7.

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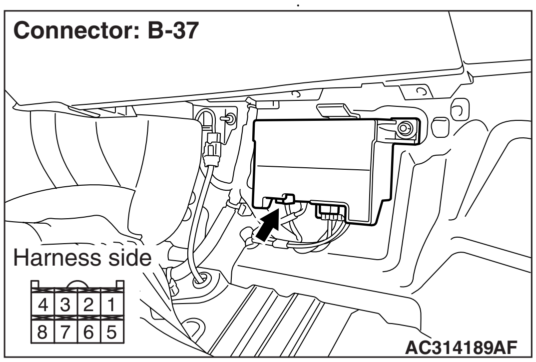
### STEP 5. Check the wiring harness wires.

*NOTE:*




*Prior to the wiring harness inspection, check junction block connectors B-110 and B-129, and repair if necessary.*




The harness wire between electric power steering-ECU connector B-37 and ignition switch (IG1) B-141

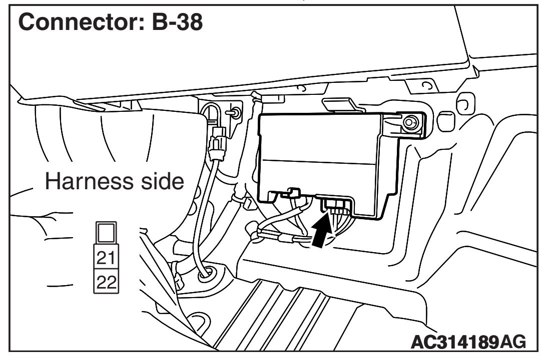
Check the harness wire above for damage or other problem.

**Q: Is the wiring harness in good condition?**

**YES :** Go to Step 8.

**NO :** Repair the wiring harness.

### STEP 6. Check the wiring harness wires.




Harness wire between electric power steering-ECU connector B-38 and fusible link No.22

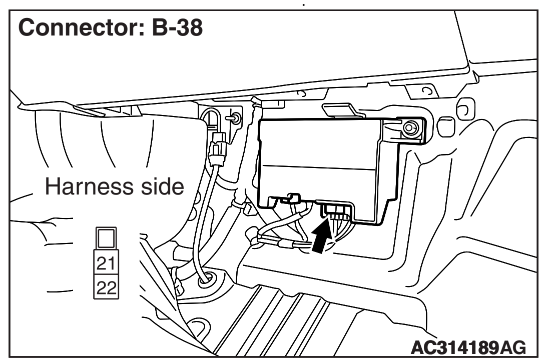
Check the harness wire above for damage or other problem.

**Q: Is the wiring harness in good condition?**

**YES :** Go to Step 8.

**NO :** Repair the wiring harness.

### STEP 7. Check the wiring harness wires.




Harness wire between electric power steering-ECU connector B-38 and body earth

Check the harness wire above for damage or other problem.

**Q: Is the wiring harness in good condition?**

**YES :** Go to Step 8.

**NO :** Repair the wiring harness.

### STEP 8. Retest the system.

**Q: Is the check result normal?**

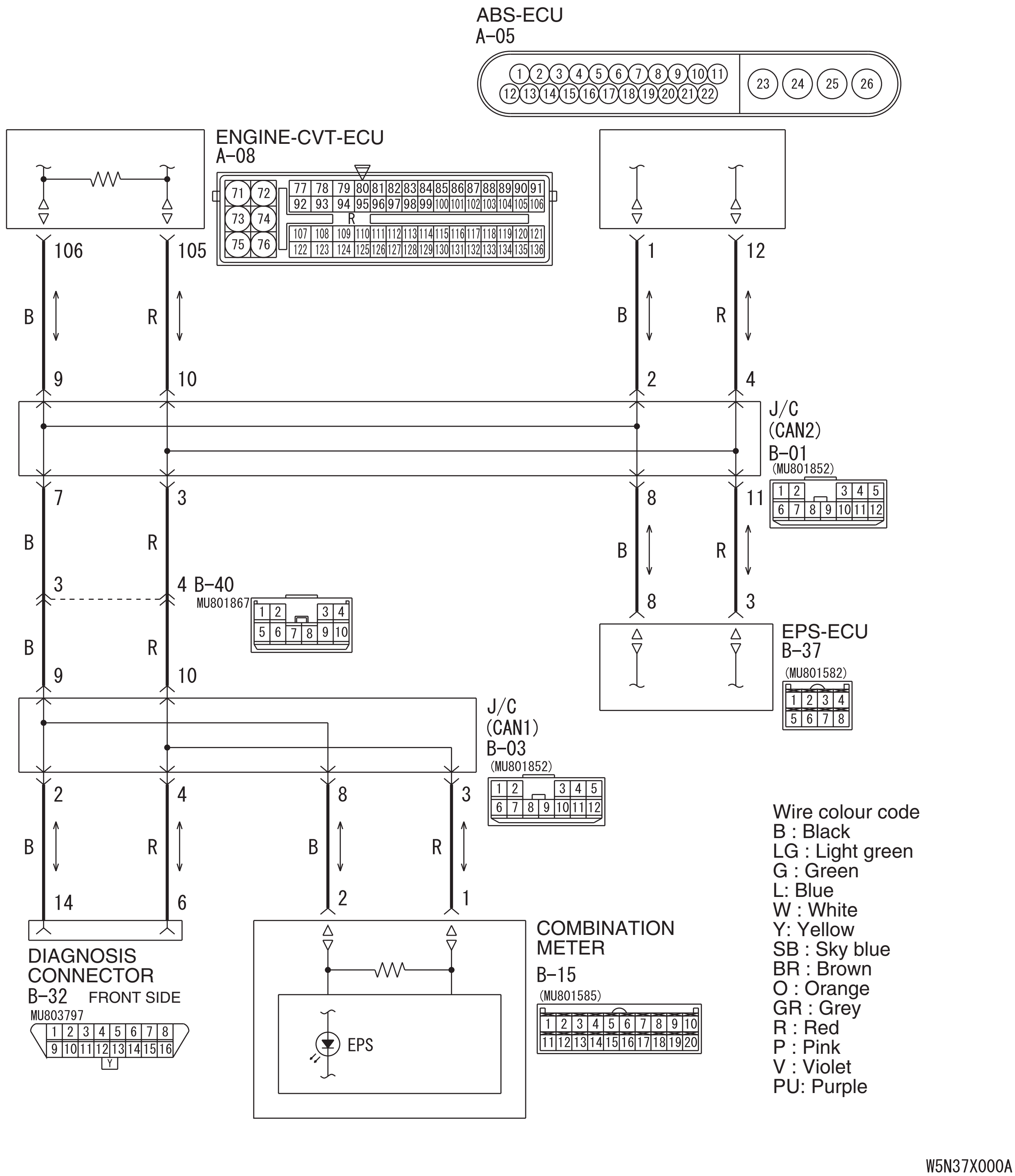
**YES :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

**NO :** Replace the electric power steering-ECU (Refer to P.37-102).

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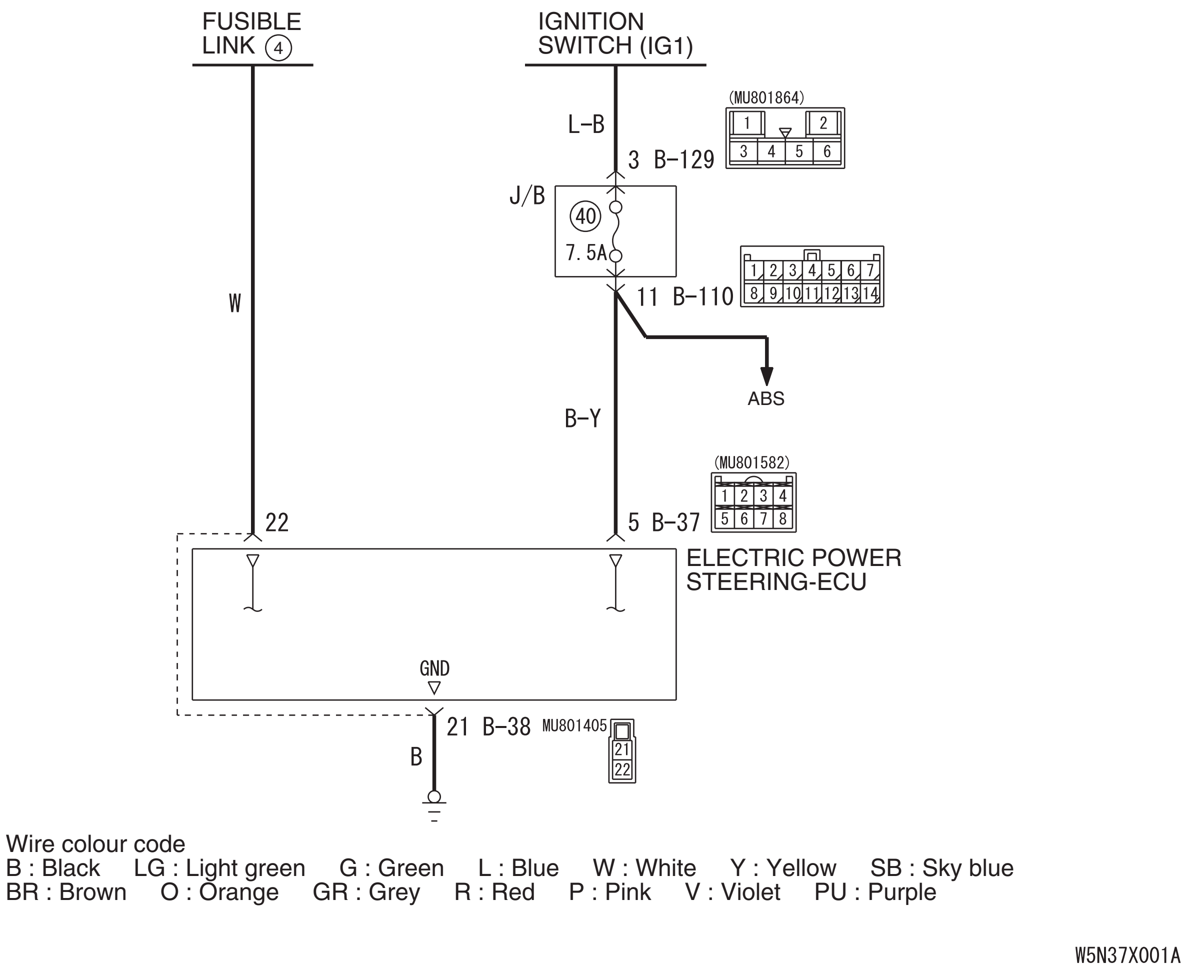
## Inspection Procedure 3: Although the electric power steering system warning lamp illuminates but diagnosis code is not stored.

**CAN Communication Circuit**



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**Power Supply and Earth Circuit**




## COMMENTS ON TROUBLE SYMPTOM

Intermittent failure may be present in the power supply system. Check the power supply and earth to the ECU, ignition signal, the battery and the alternator to confirm that normal direct current flows.

## PROBABLE CAUSES

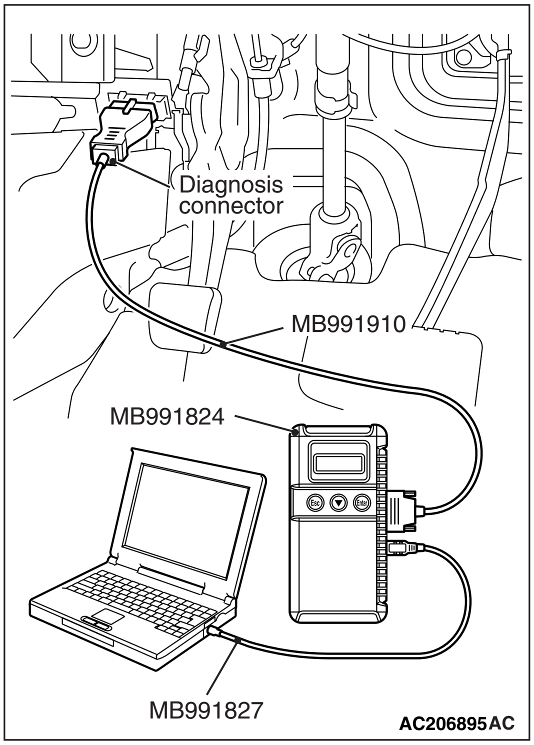
- Defective harness wire(s) or connector(s)
- Malfunction of the charging system
- Malfunction of the electric power steering-ECU

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## DIAGNOSIS PROCEDURE

### STEP 1. M.U.T.-III CAN bus diagnostics

⚠ CAUTION



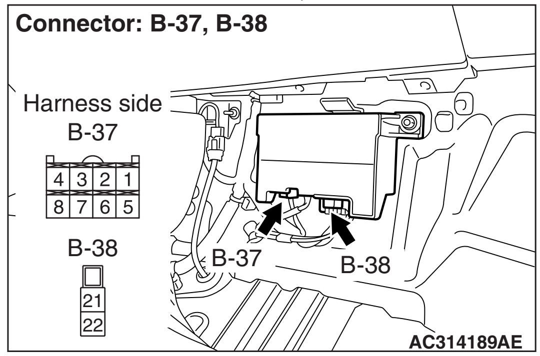

**Before connecting or disconnecting the M.U.T.-III, turn the ignition switch to the "LOCK" (OFF) position.**

(1) Connect M.U.T.-III to the 16-pin diagnosis connector.
(2) Turn the ignition switch to the "ON" position.
(3) Diagnose the CAN bus line.
(4) Turn the ignition switch to the "LOCK" (OFF) position.

**Q: Is the check result normal?**

**YES : .** Go to Step 2.
**NO : .** Repair the CAN bus line (Refer to GROUP 54D, Diagnosis P.54D-13).

### STEP 2. Check the connectors and terminals.




Electric power steering-ECU connectors B-37 and B-38

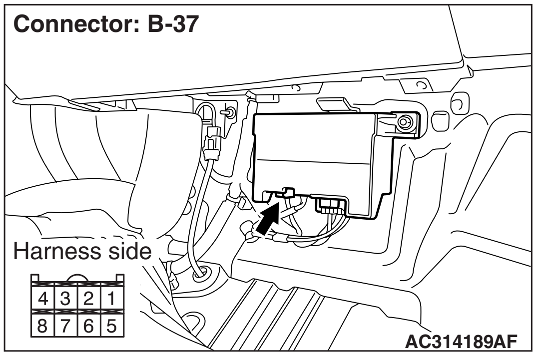
Check the connectors above for improper engagement, terminal damage or terminal drawn in the connector case.

**Q: Are the connectors and terminals in good condition?**

**YES :** Go to Step 3.
**NO :** Repair the harness connector.

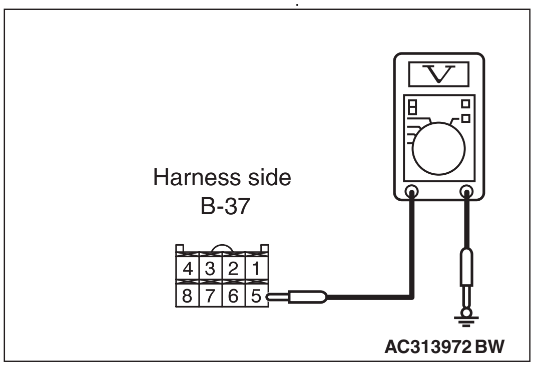
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### STEP 3. Voltage measurement at electric power steering-ECU connector B-37.




Disconnect the connector, and measure at the wiring harness side.

- Ignition switch: ON



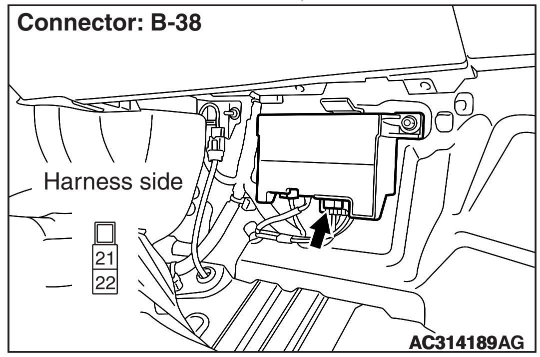

Measure the voltage between electric power steering-ECU connector B-37 terminal No.5 and body earth

**OK: system voltage**

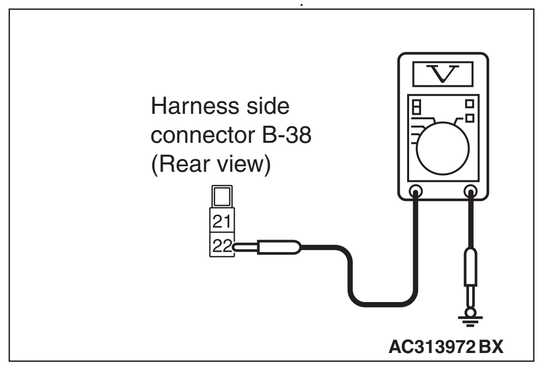
**Q: Is the check result normal?**

**YES :** Go to Step 4.
**NO :** Go to Step 6.

### STEP 4. Voltage measurement at electric power steering-ECU connector B-38.




Disconnect the connector, and measure at the wiring harness side.




Measure the voltage between electric power steering-ECU connector B-38 terminal No.22 and body earth

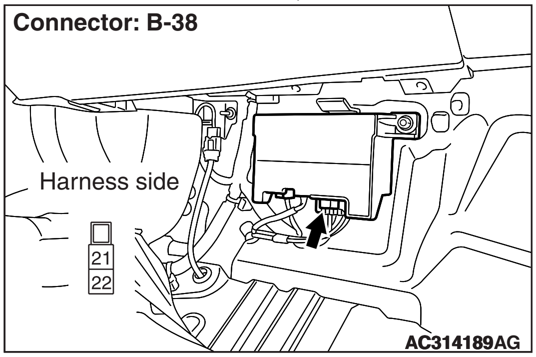
**OK: system voltage**

**Q: Is the check result normal?**

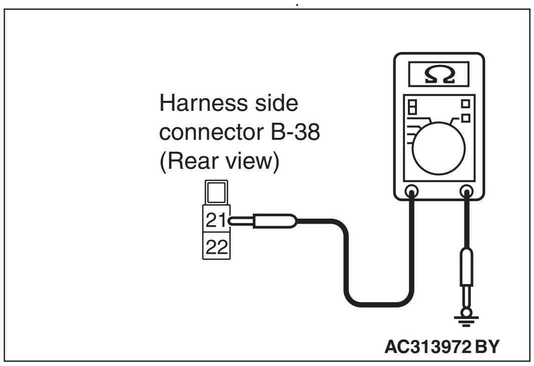
**YES :** Go to Step 5.
**NO :** Go to Step 7.

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### STEP 5. Resistance measurement at electric power steering-ECU connector B-38.




Disconnect the connector, and measure at the wiring harness side.




Measure the resistance between electric power steering-ECU connector B-38 terminal No.21 and body earth

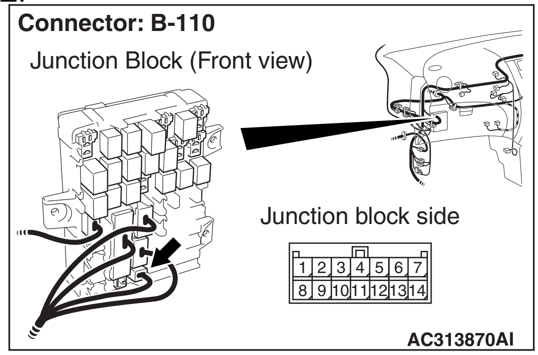
**OK: Continuity exists (2 Ω or less)**

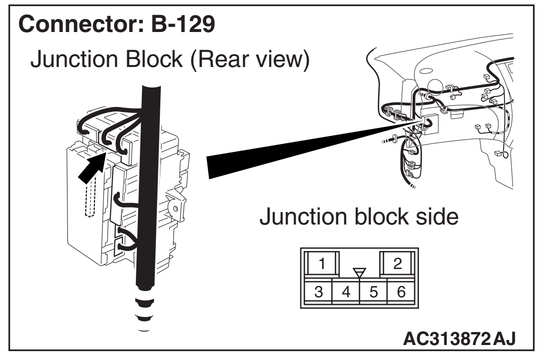
**Q: Is the check result normal?**

**YES :** Go to Step 9.
**NO :** Go to Step 8.

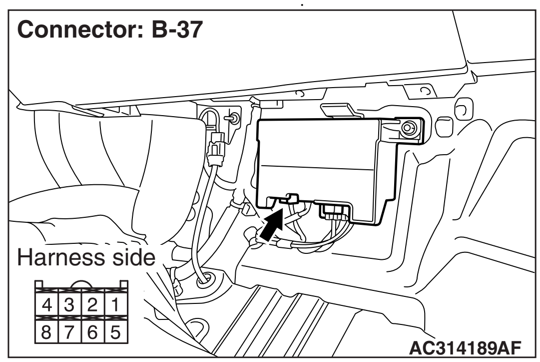
### STEP 6. Check the harness wires.

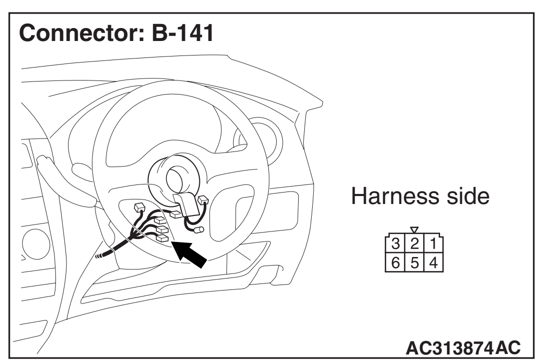
*NOTE:*




*Prior to this harness wire check, check junction block connectors B-110 and B-129, and repair if necessary.*




The harness wire between electric power steering-ECU connector B-37 and ignition switch (IG1) B-141

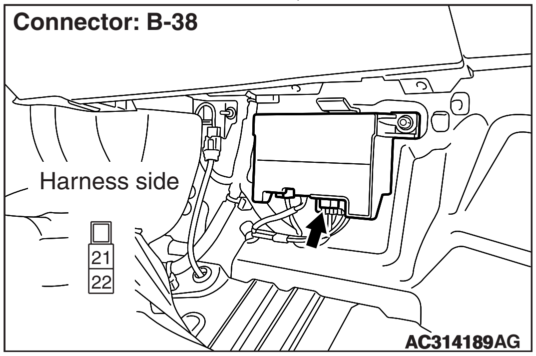
Check the harness wire above for damage or other problem.

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 11.
**NO :** Repair the harness wire.

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### STEP 7. Check the harness wires.




Harness wire between electric power steering-ECU connector B-38 and fusible link No.22

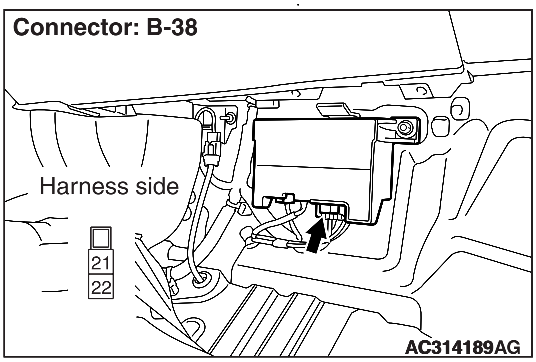
Check the harness wire above for damage or other problem.

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 11.

**NO :** Repair the harness wire.

### STEP 8. Check the harness wires.




Harness wire between electric power steering-ECU connector B-38 and body earth

Check the harness wire above for damage or other problem.

**Q: Is the harness wire in good condition?**

**YES :** Go to Step 11.

**NO :** Repair the harness wire.

### STEP 9. Check the battery

Refer to GROUP 54A, Battery Test P.54A-5.

**Q: Is the battery in good condition?**

**YES :** Go to Step 10.

**NO :** Charge or replace the battery.

### STEP 10. Check the charging system.

Refer to GROUP 16, Charging System P.16-11.

**Q: Is the charging system in good condition?**

**YES :** Go to Step 11.

**NO :** Repair or replace the charging system.

### STEP 11. Retest the system.

**Q: Is the check result normal?**

**YES :** The malfunction is intermittent. Refer to GROUP 00, How to Use Troubleshooting/Inspection Service Points – How to Cope with Intermittent Malfunction P.00-13.

**NO :** Replace the electric power steering-ECU (Refer to P.37-102).

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## DATA LIST REFERENCE TABLE

M1372007700062

The following items can be read by the M.U.T.-III from the electric power steering-ECU input data.

**When the system is normal.**

| Item No. | Check item | Check condition | | Normal condition |
|---|---|---|---|---|
| 01 | Torque sensor (main) | • Start the engine.<br>• Turn the steering wheel with a vehicle stationary. | Centre position | Approximately 2500 mV |
| | | | Steering wheel turned to right | 2500 – 4500 mV |
| | | | Steering wheel turned to left | 500 – 2500 mV |
| 02 | Torque sensor (sub) | • Start the engine.<br>• Turn the steering wheel with a vehicle stationary. | Centre position | Approximately 2500 mV |
| | | | Steering wheel turned to right | 2500 – 500 mV |
| | | | Steering wheel turned to left | 4500 – 2500 mV |
| 03 | Torque sensor supply voltage* | Start the engine. | | 3750 – 4250 mV |
| 05 | Motor current | • Start the engine.<br>• Turn the steering wheel to the left and right with a vehicle stationary. | | Approximately 50 A or less (When the steering wheel is not operated, approximately 0 V) |
| 06 | Motor current (desired value) | • Start the engine.<br>• Turn the steering wheel to the left and right with a vehicle stationary. | | Approximately 50 A or less (When the steering wheel is not operated, approximately 0 V) |
| 07 | Assist limit current (limit value) | • Start the engine.<br>• Turn the steering wheel to the left and right with a vehicle stationary. | | Approximately 50 A or less (After at least 10 minutes without operating the steering wheel, approximately 50 A) |
| 10 | Relay voltage | • Start the engine.<br>• Turn the steering wheel to the left and right with a vehicle stationary. | | B+ (approximately 12 V) or less |
| 11 | Vehicle speed | Perform a test run of the vehicle. | | Speedometer displayed value and M.U.T.-III displayed value agree with each other. |
| 12 | Engine speed | Start the engine. | | Tachometer displayed value and M.U.T.-III displayed value agree with each other. |

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| Item No. | Check item | Check condition | Normal condition |
|---|---|---|---|
| 14 | Fail-safe relay | Stop the engine. (Ignition switch: ON) | OFF |
| | | Start the engine, and let it idle. | ON |
| 15 | Ignition switch key signal | Ignition switch: from ON to OFF | OFF |
| | | Ignition switch: ON | ON |

*NOTE: Item No.13 (idle-up relay) is displayed on M.U.T.-III. In this case, however, the idle-up signal is not accepted by the engine-ECU, and the idle speed will not actually increase. Therefore, the item No.13 is excluded from the above table.*

*NOTE: *: Torque sensor is supplied either with 3 V or 8 V. Only the 8 V side of the torque sensor power supply can be monitored by M.U.T.-III as service data (Output is 8V x 0.5). Even though the 8 V-ide torque sensor power supply is normal, diagnosis code C1514 (abnormal torque sensor power supply) is displayed if any malfunction occurs in the 3 V-side power supply.*

### When the electric power steering-ECU shut off electric power steering system operation.

When the diagnosis system stops the electric power steering-ECU, the M.U.T.-III display data will be unreliable.

## ACTUATOR TEST REFERENCE TABLE

M1372007800047

The M.U.T.-III activates the following actuators for testing.

*NOTE: If the electric power steering-ECU runs down, actuator testing cannot be carried out.*

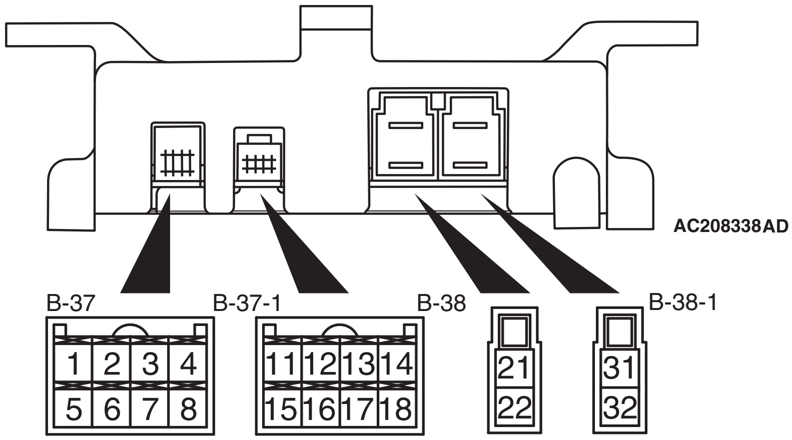
*NOTE: Actuator testing is only possible when the vehicle is stationary.*

| No. | Item | |
|---|---|---|
| 01 | Vehicle speed 5km/h | Forced vehicle speed sensitivity |
| 02 | Vehicle speed 25km/h | |
| 03 | Vehicle speed 50km/h | |
| 04 | Vehicle speed 75km/h | |
| 05 | Vehicle speed 100km/h | |
| 06 | Forced idle up ON | Forced idle up ON<br>No idle-up |
| 00 | Forced idle up OFF (Plant) | |

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## CHECK AT ELECTRIC POWER STEERING-ECU

M1372008000066




| Terminal No. | Check item | Checking requirement | Normal condition |
|---|---|---|---|
| 5 | Ignition key signal | Ignition switch: ON | System voltage |
| | | Ignition switch: OFF | 0 V |
| 12 | Torque sensor main signal | • Start the engine.<br>• Turn the steering wheel to the left and right with a vehicle stationary. | 0.5 – 4.5 V (When the steering wheel is not operated, approximately 2.5 V) |
| 13 | Torque sensor GND | Always | 0 V |
| 14 | 8 V-power supply to the torque sensor | Start the engine, and let it idle. | 7.6 – 8.4 V |
| 15 | Torque sensor shield earth | Always | 0 V |
| 16 | Torque sensor sub signal | • Start the engine.<br>• Turn the steering wheel to the left and right with a vehicle stationary. | 0.5 – 4.5 V (When the steering wheel is not operated, approximately 2.5 V) |
| 18 | 3 V-power supply to torque sensor | Ignition switch: ON | 2.93 – 3.07 V |
| 21 | Earth | Always | 0 V |
| 22 | Battery power supply | Always | System voltage |
| 31 | Motor (L) | • Start the engine.<br>• Turn the steering wheel to the left with a vehicle stationary. | Approximately 50 A or less |
| 32 | Motor (R) | • Start the engine.<br>• Turn the steering wheel to the right with a vehicle stationary. | Approximately 50 A or less |

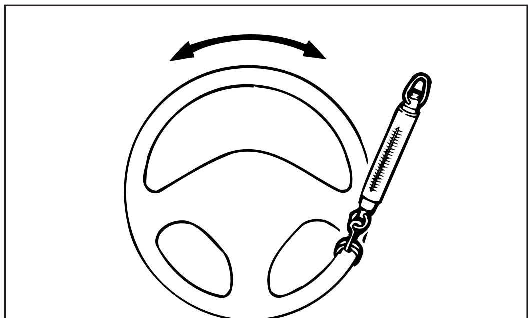
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# ON-VEHICLE SERVICE

## STEERING WHEEL FREE PLAY CHECK

M1372001000582

1. With the engine running, set the front wheels straight ahead.



AC000987

2. Measure the play on the steering wheel circumference before the tyre & wheel start to move when slightly moving the steering wheel in both directions.

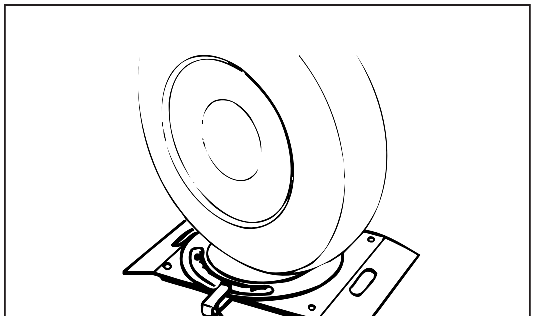
   **Limit: 30 mm**

3. When the play exceeds the limit, check for the play on the steering shaft and steering linkage connection. Correct or replace.
4. If the play still exceeds the specification after inspecting item 3, inspect the steering gear & linkage assembly, and replace as necessary (Refer to P.37-101).

## STEERING ANGLE CHECK

M1372001100857

1. Adjust toe-in (Refer to GROUP 33, On-vehicle Service – Front Wheel Alignment Check and Adjustment P.33-5).



AC000756AB

2. Place the front wheel on a turning radius gauge and measure the steering angle.

   **Standard value:**

| | | |
|---|---|---|
| Inner wheels | Vehicles with 14-inch wheels | 41° 40' ± 1° 30' |
| | Vehicles with 15-inch wheels | 39° 00' ± 1° 30' |
| | Vehicles with 16-inch wheels | 34° 10' ± 1° 30' |
| Outer wheels (reference) | Vehicles with 14-inch wheels | 35° 30' |
| | Vehicles with 15-inch wheels | 33° 40' |
| | Vehicles with 16-inch wheels | 30° 00' |

3. If not within the specification, replace the steering gear and linkage assembly (Refer to P.37-96).

## TIE ROD END BALL JOINT TURNING TORQUE CHECK

M1372001500651

## BALL JOINT LOOSENESS CHECK

1. Raise the vehicle.
2. Inspect the ball joint for looseness in the axial direction while shaking the tie-rod end vertically. If there is looseness, replace the tie-rod end assembly.

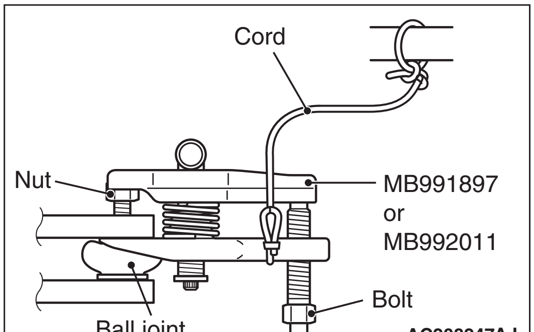
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## BALL JOINT ROTATIONAL STARTING TORQUE CHECK

**⚠ CAUTION**

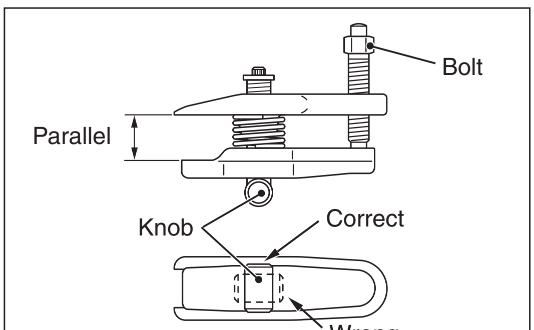
- **Do not remove the nut from ball joint. Loosen it and use the special tool to avoid possible damage to ball joint threads.**
- **Hang the special tool with cord to prevent it from falling.**

<4A9>



AC208247AJ

1. Install special tool ball joint remover (MB991897 or MB992011) as shown in the figure.



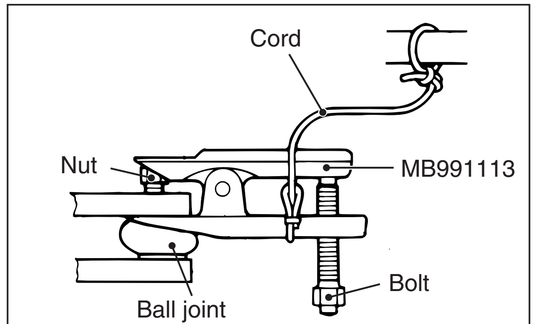
AC106821AD

2. Turn the bolt and knob as necessary to make the jaws of special tool  parallel, tighten the bolt by hand and confirm that the jaws are still parallel.

   *NOTE: When adjusting the jaws in parallel, make sure the knob is in the position shown in the figure.*

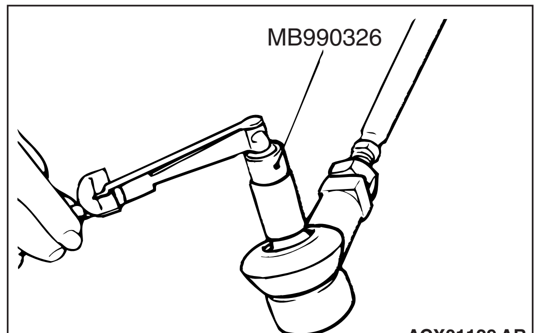
3. Tighten the bolt with a wrench to disconnect the tie rod end, lower arm ball joint.

<4G1>



AC102599AC

Replace the self-locking nut with a regular nut, and then install special tool steering linkage puller (MB991113) as shown in the figure.



ACX01129 AB

4. Move the ball joint stud several times and install the nut on the stud. Using special tool preload socket (MB990326), measure the ball joint turning torque.

   **Standard value: 10 N·m or less**

5. If the turning torque exceeds the standard value, replace the tie rod end.
6. If the turning torque is under the standard value, check the ball joint for axial play or ratcheting. If no axial play or ratcheting, the ball joint can be re-used.

**⚠ CAUTION**

**Always use a new ball joint nut as it is a self-locking nut.**

7. Install the tie rod end to the knuckle, then tighten a new self-locking nut to the specified torque.

   **Tightening torque: 25 ± 5 N·m <4A9>**
   **Tightening torque: 28 ± 3 N·m <4G1>**

## CHECK OF STEERING FORCE TO LOCK

M1372001700688

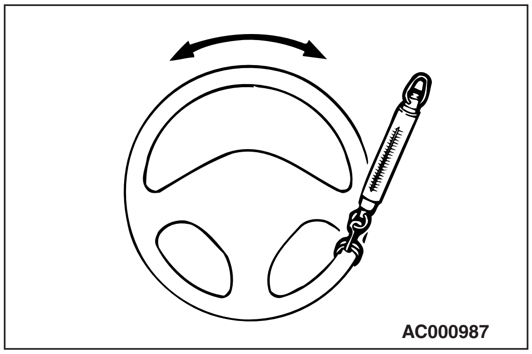
1. Verify that the tyre pressure is within the specification. Use tyres with more than 80% of the tread depth remained.

   **Specified tyre inflation pressure: 220 kPa**

2. Place the vehicle on a level surface and turn the steering wheel to the straight ahead position.

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3. Start the engine.




4. Attach a spring scale to the circumference of the steering wheel and measure the steering force when the steering wheel is turned to left and right from the straight ahead position within 90 °. At the same time, verify that the steering force does not vary excessively in both directions.

**Standard value:**

| | | |
|---|---|---|
| Steering force | 4A9 | 25 N or less |
| | 4G1 | 40 N or less |
| Fluctuation | 4A9 | 6.0 N or less |
| | 4G1 | 10.0 N or less |

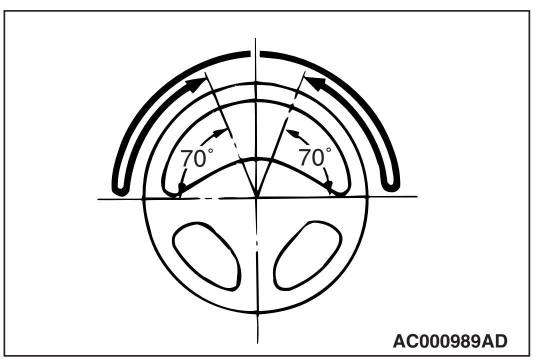
5. If not within the specification, inspect and adjust the steering system components.

## STEERING WHEEL RETURN TO CENTRE CHECK

M1372001800436

Carry out the test run for return check and check the following.

1. Carry out gentle cornering and hard cornering and check the steering force and the return do not have the difference between left and right by the feeling.




2. Turn the steering wheel at a 90° angle and keep it for a few seconds while driving at about 35 km/h speed and then check that the steering wheel returns more than 70° when taking hand off.

## TIE ROD END BALL JOINT DUST COVER CHECK

M1372008600381

1. Press the dust cover with your finger to check whether the dust cover is cracked or damaged.
2. If the dust cover is cracked or damaged, replace the tie rod end.

   *NOTE: If the dust cover is cracked or damaged, the ball joint could be damaged.*

## STEERING COLUMN SHAFT ASSEMBLY SHOCK ABSORBING MECHANISM CHECK

M1372013500368

If a collision accident occurs or severe impact is applied on the steering wheel, the collision energy absorbing mechanism may have operated. Once the mechanism has operated, it will be inoperative even it has suffered no apparent damage. Determine if the steering column shaft can be reused by the following procedure. If the collision energy absorbing mechanism has already operated, replace the steering column shaft assembly.

If any excessive radial free play on the steering wheel is found with the tilt lever in the lock position, always check the steering shaft assembly.

⚠ ***WARNING***

***If the vehicle continues to be driven after the collision absorbing mechanism has operated, the steering column shaft may be damaged while it is in use.***

# STEERING WHEEL

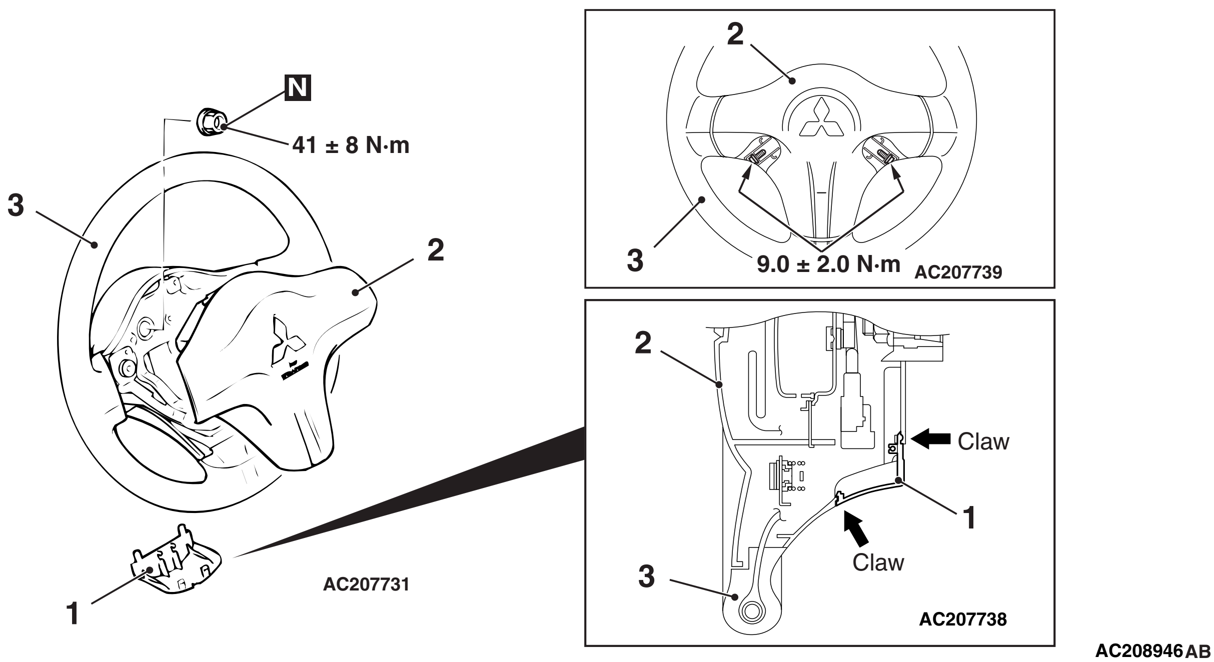
## REMOVAL AND INSTALLATION

M1372011400365

**⚠ WARNING**

- ***Before removing the steering wheel and air bag module assembly, refer to GROUP 52B, Service Precautions (P.52B-5) and Driver's, Front Passenger's Air Bag Module(s) and Clock Spring (P.52B-145).***
- ***When removing and installing the steering wheel, do not let it bump against the air bag module.***

**Post-installation Operation**
- Checking Steering Wheel Position with Wheels Straight Ahead
- Steering wheel free play check (Refer to P.37-87).




| | | | Removal steps |
|---|---|---|---|
| <<A>> | >>A<< | 1. | Steering wheel lower cover |
| | | • | Horn connector connection |

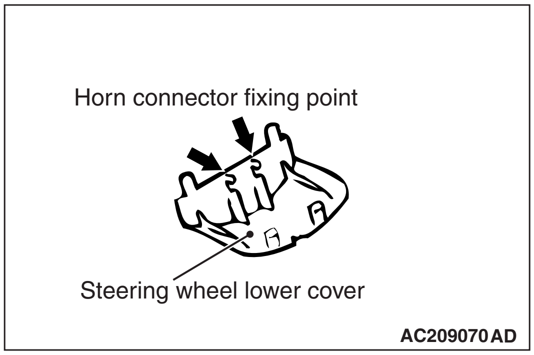
| | | | Removal steps (Continued) |
|---|---|---|---|
| <<B>> | | • | Air bag module connector connection |
| <<C>> | | 2. | Air bag module |
| <<D>> | | 3. | Steering wheel assembly |

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## REMOVAL SERVICE POINTS

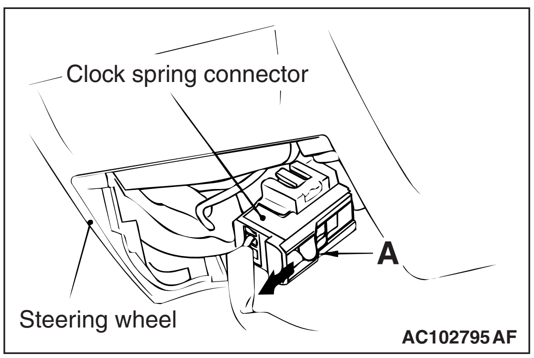
### <<A>> STEERING WHEEL LOWER COVER REMOVAL

1. Using the ornament remover (special tool MB990784), remove the steering wheel lower cover.




2. Disconnect the horn connector secured to the steering wheel lower cover.

### <<B>> AIR BAG MODULE CONNECTOR DISCONNECTION




Disconnect the connector while sliding the part "A" of the clock spring connector shown in the figure in the direction of an arrow.

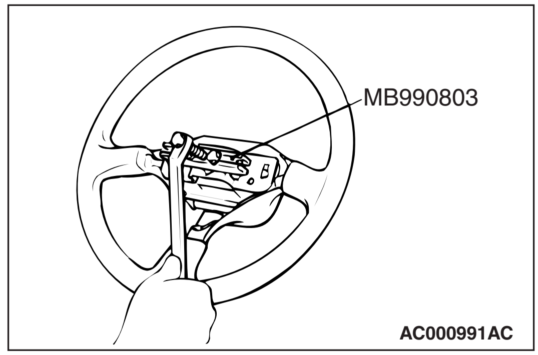
### <<C>> AIR BAG MODULE REMOVAL

**⚠ CAUTION**

- **Never use an electric tester to diagnose the air bag module circuit. Never attempt to disassemble the air bag module.**
- **Be sure to store the removed air bag module in a clean and dry place with a pad surface facing upward.**

### <<D>> STEERING WHEEL ASSEMBLY REMOVAL

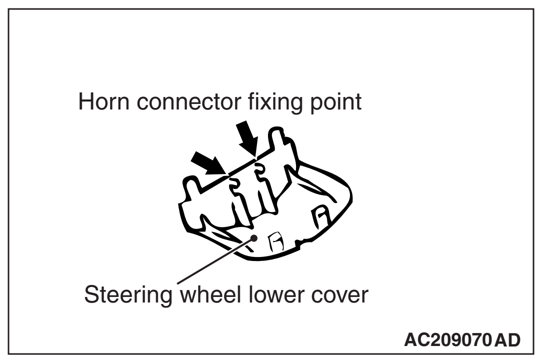
1. Position the steering wheel in a straight-ahead direction.




2. Using the special tool (Steering wheel puller, MB990803), remove the steering wheel assembly as shown in the figure.

## INSTALLATION SERVICE POINTS

### >>A<< STEERING WHEEL LOWER COVER INSTALLATION




1. Secure the horn connector to the steering wheel lower cover.
2. Install the steering wheel lower cover to the steering wheel assembly.

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# STEERING SHAFT

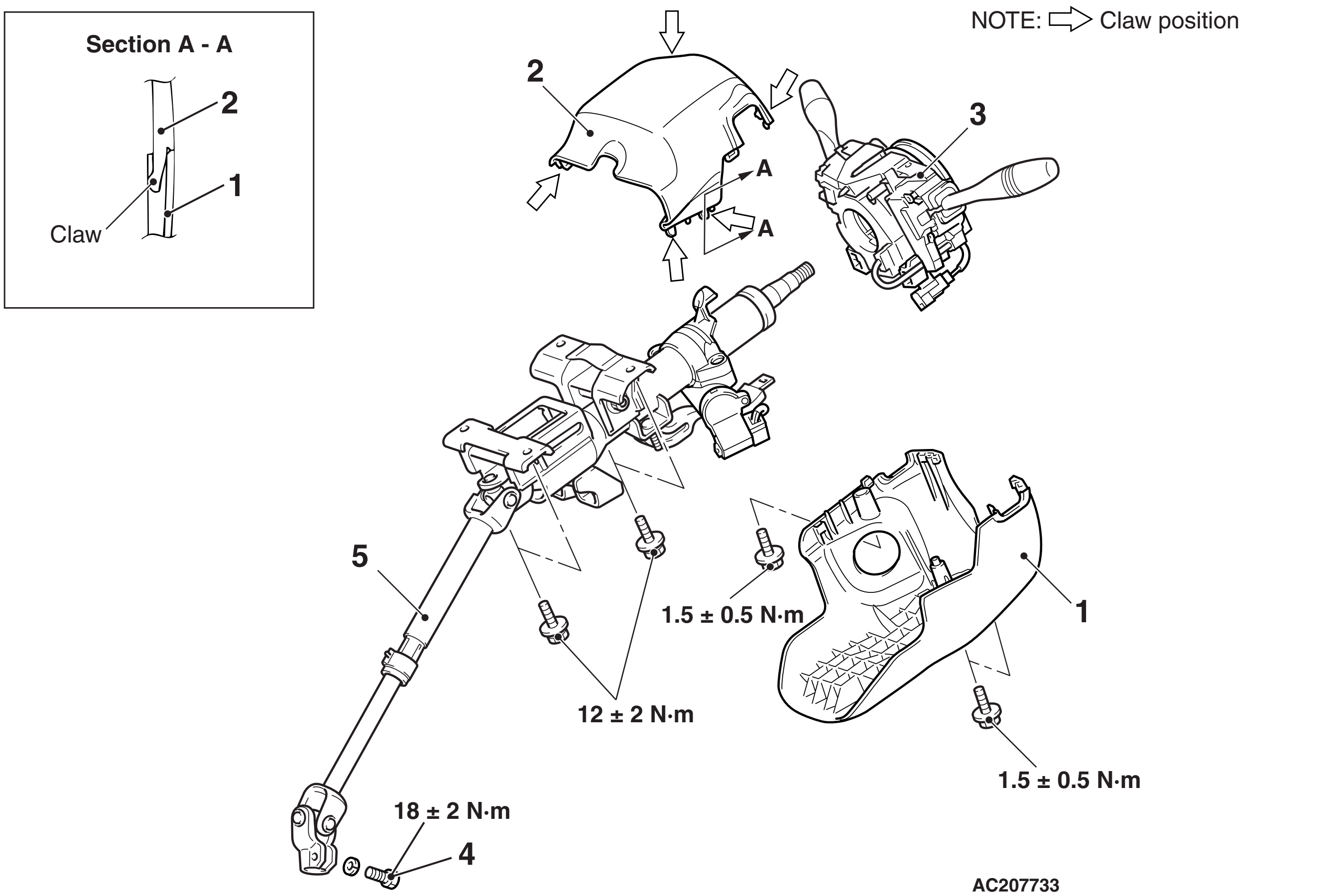
## REMOVAL AND INSTALLATION

M1372011500276

⚠ **WARNING**

***Before removing the steering wheel and air bag module assembly, refer to GROUP 52B, Service Precautions (P.52B-5) and Driver's, Front Passenger's Air Bag Module(s) and Clock Spring (P.52B-145).***

| **Pre-removal Operation** | **Post-installation Operation** |
|---|---|
| • Steering Wheel and Air bag Module Assembly Removal (Refer to P.37-90).<br>• Lower Panel Removal (Refer to GROUP 52A, Instrument Panel Assembly P.52A-3). | • Lower Panel Installation (Refer to GROUP 52A, Instrument Panel Assembly P.52A-3).<br>• Steering Wheel and Air bag Module Assembly Installation (Refer to P.37-90). |




AC208339AC

**Removal steps**

1. Steering column lower cover
2. Steering column upper cover

• Peripheral connectors and clamps of the steering column assembly

>>**B**<< 3. Clock spring and column switch assembly (Refer to GROUP 52B, Driver's, Front Passenger's Air Bag Module(s) and Clock Spring P.52B-145).

**Removal steps (Continued)**

• Selector lever assembly (Refer to GROUP 23A, Transmission Control P.23A-146).

4. Steering gear and steering column assembly connection

>>**A**<< 5. Steering column assembly

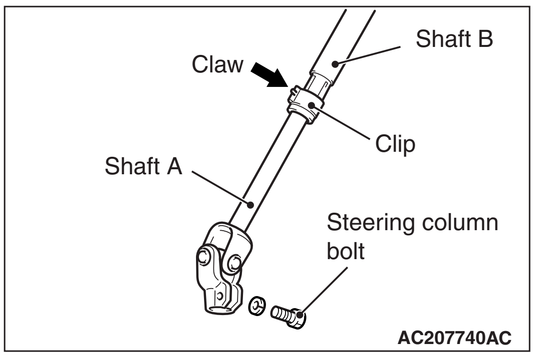
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## REMOVAL SERVICE POINTS

### <<A>> STEERING GEAR AND STEERING COLUMN ASSEMBLY DISCONNECTION

**⚠ CAUTION**

**The tilt lever should be held in the lock position until the steering column assembly is installed to the vehicle. If the steering column assembly is removed with the tilt lever released, or the tilt lever is released with the steering column assembly removed from the vehicle, you cannot reinstall the steering column properly.**



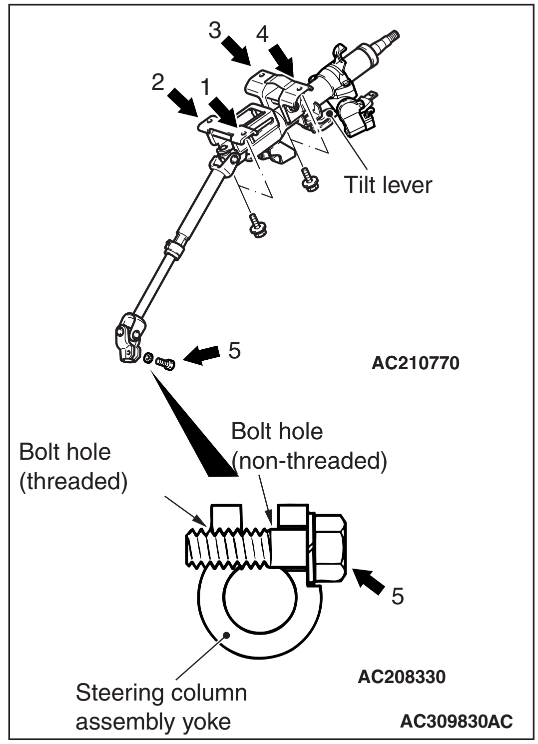

1. Remove the steering column bolt connecting steering gear to steering column assembly.
2. Disconnect the steering gear from the steering column assembly while sliding shaft A to shaft B with the clip claw as shown is pinched.
3. Ensure that the tilt lever is in the lock position, and remove the steering column mounting bolts.

## INSTALLATION SERVICE POINTS

### >>A<< STEERING COLUMN ASSEMBLY INSTALLATION/STEERING GEAR AND COLUMN ASSEMBLY CONNECTION

**⚠ CAUTION**

**Do not release the tilt lever until the steering column assembly has been installed.**




Ensure that the tilt lever is in the lock position, and install the steering column assembly as described below.

1. Finger-tighten the mounting bolts in order of 2, 3 and 4. Then tighten them to the specified torque in order of 1, 2, 3 and 4.

   **Tightening torque: 12 ± 2 N·m**

2. Insert the bolt connecting the steering column assembly with the steering gear into the non-threaded bolt hole.
3. Tighten mounting bolt 5 to the specified torque.

   **Tightening torque: 18 ± 2 N·m**

### >>B<< CLOCK SPRING AND STEERING COLUMN SWITCH ASSEMBLY INSTALLATION

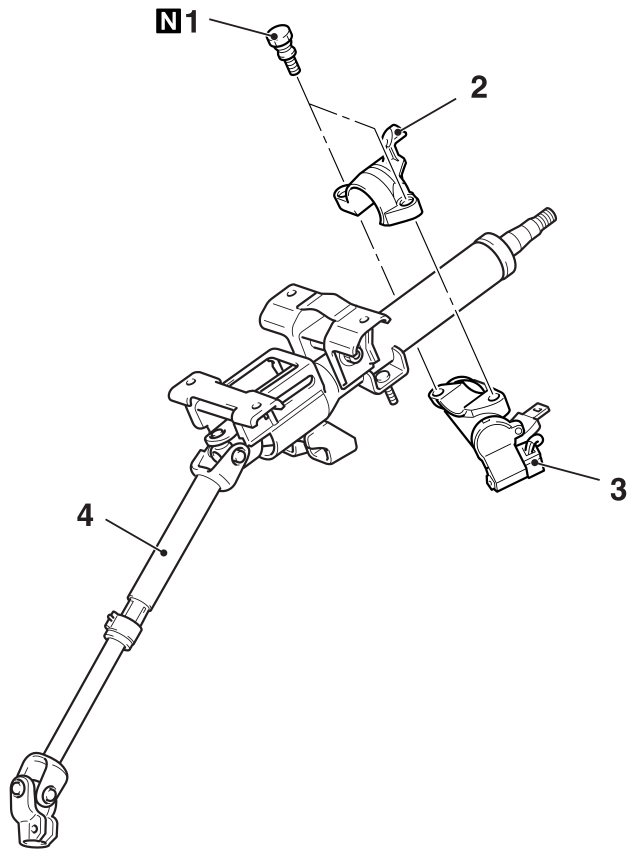
Install the clock spring and steering column switch assembly, and then centralise the clock spring (Refer to GROUP 52B, Driver's, Front Passenger's Air Bag Module(s) and Clock Spring P.52B-145).

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## DISASSEMBLY AND REASSEMBLY

M1372011700184



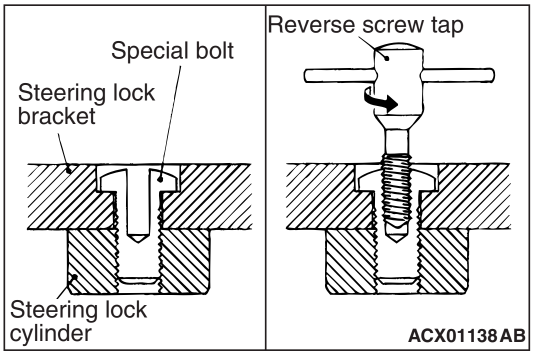

**Disassembly steps**

| | | | |
|---|---|---|---|
| <<**A**>> | >>**A**<< | 1. | Special bolt |
| | >>**A**<< | 2. | Engine starting switch bracket |
| | >>**A**<< | 3. | Engine starting switch assembly |
| | | 4. | Steering column assembly |

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## DISASSEMBLY SERVICE POINT

### <<A>> SPECIAL BOLT REMOVAL




1. Drill in the special bolt a hole deep enough for the tap to stand.
2. Remove the special bolt with a left-hand tap.

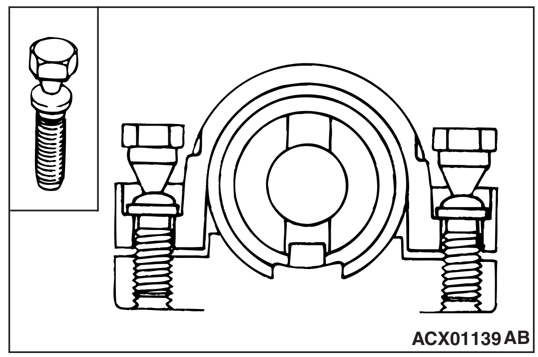
## REASSEMBLY SERVICE POINT

### >>A<< ENGINE STARTING SWITCH ASSEMBLY/ENGINE STARTING SWITCH BRACKET/SPECIAL BOLT INSTALLATION

⚠ CAUTION

**The engine starting switch bracket and bolts must be replaced with new ones when the engine starting switch is installed.**

1. When installing the engine starting switch assembly and engine starting switch bracket to the steering column assembly, temporarily install the engine starting switch in alignment with the column boss.




2. After checking that the lock works properly, tighten the special bolts until the head twists off.

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# POWER STEERING GEAR BOX AND LINKAGE

## REMOVAL AND INSTALLATION

M1372010900828

**⚠ WARNING**

***Before removing the steering gear, refer to GROUP 52B, Service Precautions (P.52B-5) and Driver's, Front Passenger's Air Bag Module(s) and Clock Spring (P.52B-145). Position the front wheels in a straight-ahead direction. Failure to do so may damage the SRS clock spring and render the SRS system inoperative, risking serious injury.***

**Operations before Steering Gear and Linkage Assembly Removal**

- Front Under Cover Panel Removal (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2 ).
- Lower Arm Removal (Refer to GROUP 33, Lower Arm P.33-11 <4A9>, P.33-13 <4G1>).
- Exhaust Front Pipe Removal (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-19 <4A9>, P.15-21 <4G1>).
- Engine Roll Stopper Rod Assembly Removal (Refer to GROUP 32, Engine Roll Stopper Rod P.32-11).
- Air Bag Module and Steering Wheel Assembly Removal (Refer to P.37-90).
- Clock Spring Removal (Refer to GROUP 52B, Driver's, Front Passenger's Air Bag Module(s) and Clock Spring P.52B-145).
- Electric Power Steering Control Unit Bracket Removal (Refer to P.37-102).

**Operations after Tie-rod End Assembly Installation**

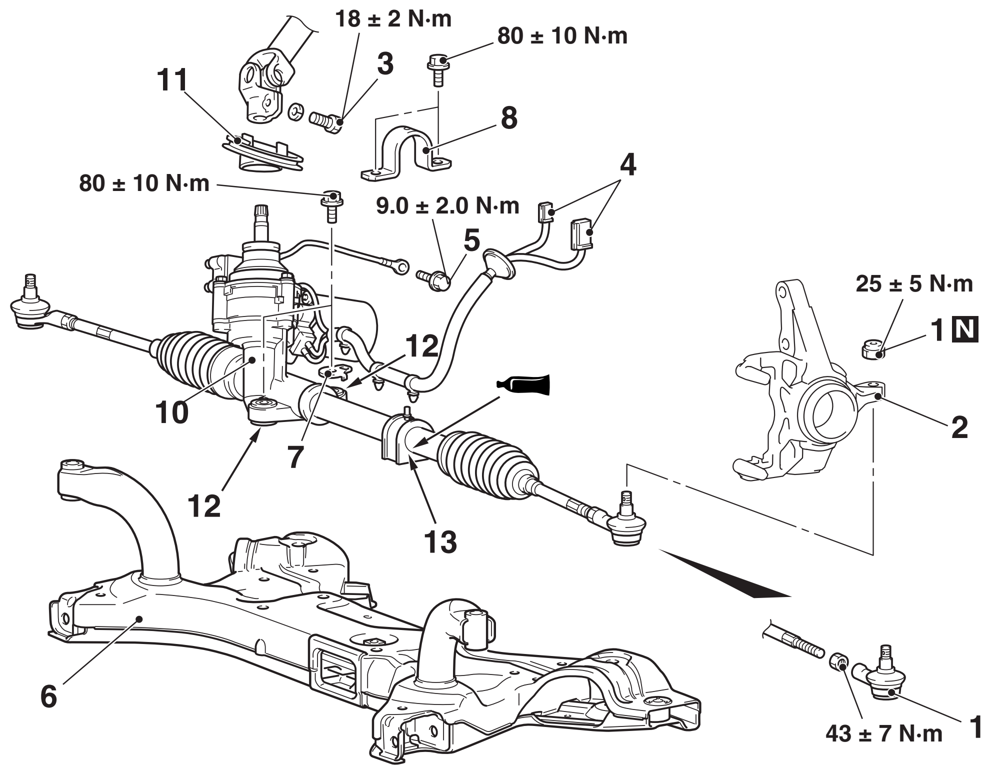
- Push the tie-rod end cover with fingers and inspect for cracks or damage.
- Wheel Alignment Check and Adjustment (Refer to GROUP 33, On-vehicle Service – Front Wheel Alignment Check and Adjustment P.33-5).

**Operations after Steering Gear and Linkage Assembly Installation**

- Push the tie-rod end cover with fingers and inspect for cracks or damage.
- Electric Power Steering Control Unit Bracket Installation (Refer to P.37-102).
- Confirm that the steering wheel is at the straight-ahead position.
- Clock Spring Installation (Refer to GROUP 52B, Driver's, Front Passenger's Air Bag Module(s) and Clock Spring P.52B-145).
- Steering Wheel Assembly and Air Bag Module Installation (Refer to P.37-90).
- Engine Roll Stopper Rod Assembly Installation (Refer to GROUP 32, Engine Roll Stopper Rod P.32-11).
- Exhaust Front Pipe Installation (Refer to GROUP 15, Exhaust Pipe and Main Muffler P.15-19 <4A9>, P.15-21 <4G1>).
- Lower Arm Installation (Refer to GROUP 33, Lower Arm P.33-11 <4A9>, P.33-13 <4G1>).
- Wheel Alignment Check and Adjustment (Refer to GROUP 33, On-vehicle Service – Front Wheel Alignment Check and Adjustment P.33-5).
- Front Under Cover Panel Installation (Refer to GROUP 51, Front Bumper Assembly and Radiator Grille P.51-2).

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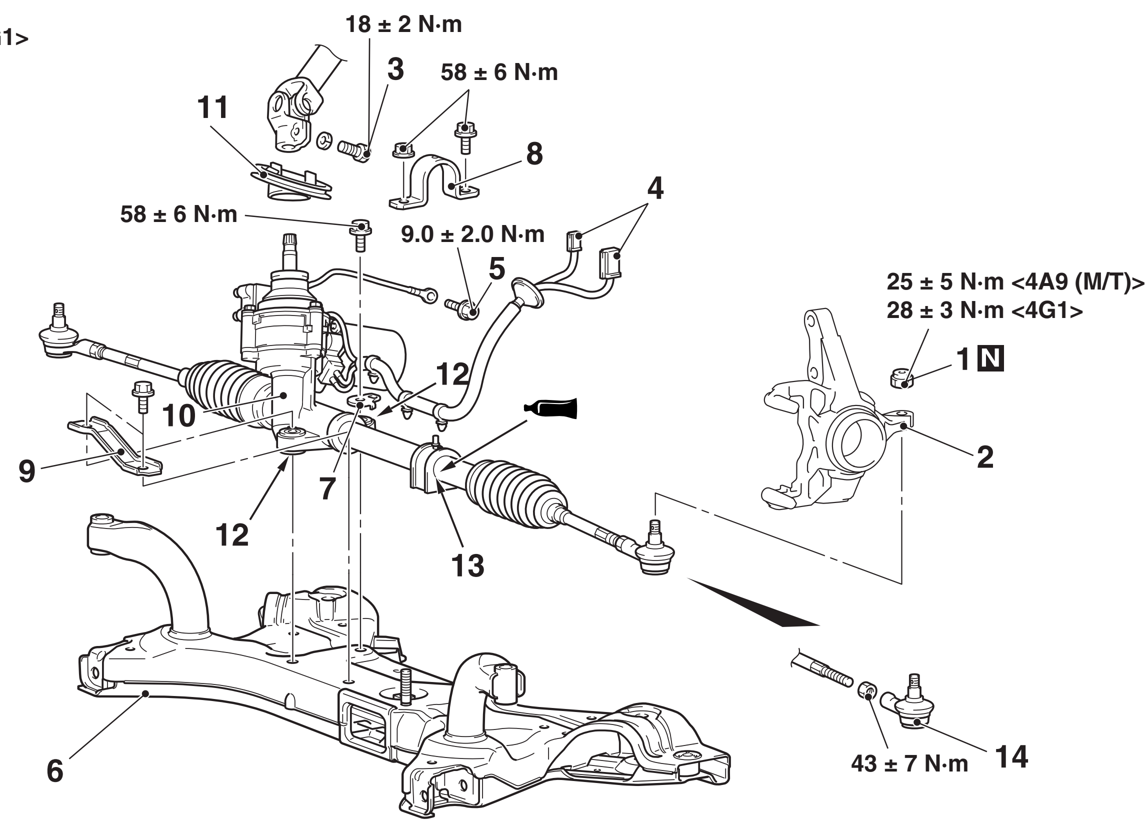
<4A9 (A/T)>




: Instant adhesive (Three Bond 1741 or equivalent)

AC601478AB

<4A9 (M/T) and 4G1>




: Instant adhesive (Three Bond 1741 or Equivalent)

AC600196AC

**Tie-rod end assembly removal steps**

1. self-locking nut

**Tie-rod end assembly removal steps (Continued)**

<<A>> 2. Tie-rod end and knuckle connection

14. Tie-rod end assembly

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**Steering gear and linkage assembly removal steps**

| | | | |
|---|---|---|---|
| | | 1. | self-locking nut |
| <<**A**>> | | 2. | Tie-rod end and knuckle connection |
| <<**B**>> | >>**G**<< | 3. | Steering gear and steering column assembly connection |
| | >>**F**<< | 4. | Steering gear connector (in-vehicle EPS-ECU) |
| | >>**E**<< | 5. | Steering gear bolt (earth bolt) |
| <<**C**>> | >>**D**<< | 6. | Front axle No.1 crossmember (Equipped with steering gear and linkage assembly, steering column dash panel cover, and stabilizer bar) |

**Steering gear and linkage assembly removal steps**

| | | |
|---|---|---|
| | 7. | Steering gear mounting crossmember plate |
| | 8. | Steering gear mounting rod side bracket |
| | 9. | Steering gear mounting bracket <4A9 (M/T) and 4G1> |
| >>**C**<< | 10. | Steering gear and linkage assembly |
| >>**B**<< | 11. | Steering column dash panel cover |
| | 12. | Steering gear bushing |
| >>**A**<< | 13. | Steering gear cushion |

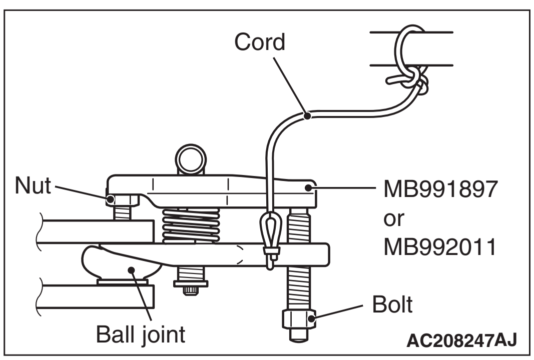
## REMOVAL SERVICE POINTS

### <<A>> TIE-ROD END AND KNUCKLE DISCONNECTION

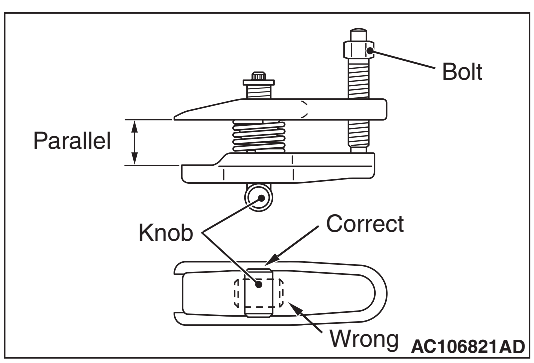
**⚠ CAUTION**

- **Do not remove the nut from ball joint. Loosen it and use the special tool to avoid possible damage to ball joint threads.**
- **Hang the special tool with cord to prevent it from falling.**

<4A9>




1. Install special tool ball joint remover (MB991897 or MB992011) as shown in the figure.

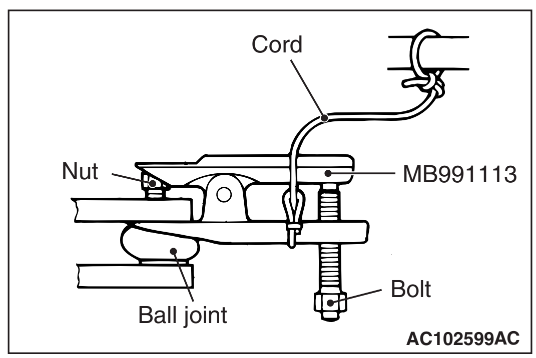



2. Turn the bolt and knob as necessary to make the jaws of special tool parallel, tighten the bolt by hand and confirm that the jaws are still parallel.

   *NOTE: When adjusting the jaws in parallel, make sure the knob is in the position shown in the figure.*

3. Tighten the bolt with a wrench to disconnect the tie rod end, lower arm ball joint.

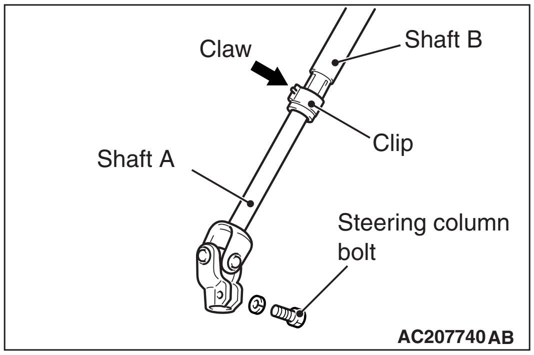
<4G1>




Replace the self-locking nut with a regular nut, and then install special tool steering linkage puller (MB991113) as shown in the figure.

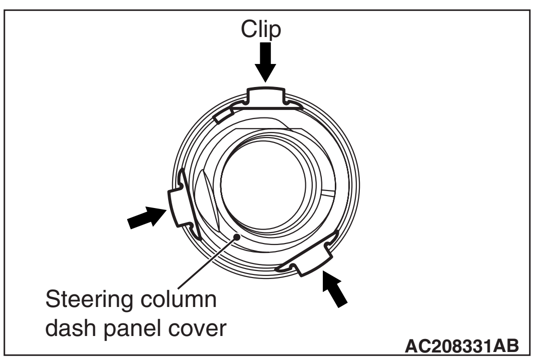
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## <<B>> STEERING GEAR AND STEERING COLUMN ASSEMBLY DISCONNECTION




1. Remove the steering column bolt connecting steering gear to steering column assembly.
2. Disconnect the steering gear from the steering column assembly while sliding shaft A to shaft B with the clip claw as shown is pinched.

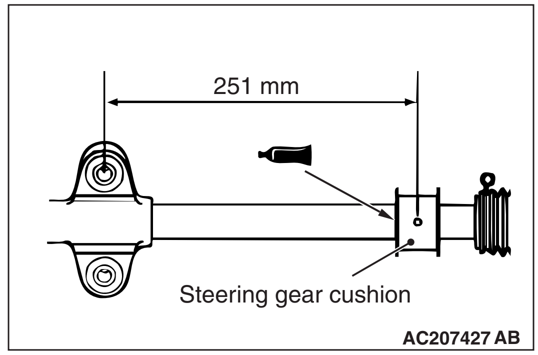
## <<C>> FRONT AXLE NO.1 CROSSMEMBER (EQUIPPED WITH STEERING GEAR AND LINKAGE ASSEMBLY, STEERING COLUMN DASH PANEL COVER, STABILIZER BAR) REMOVAL




1. Remove the 3 clips (shown in the figure) from inside of the vehicle and drop the steering column dash panel cover through the body panel.
2. Remove the front axle No.1 crossmember.

## INSTALLATION SERVICE POINTS

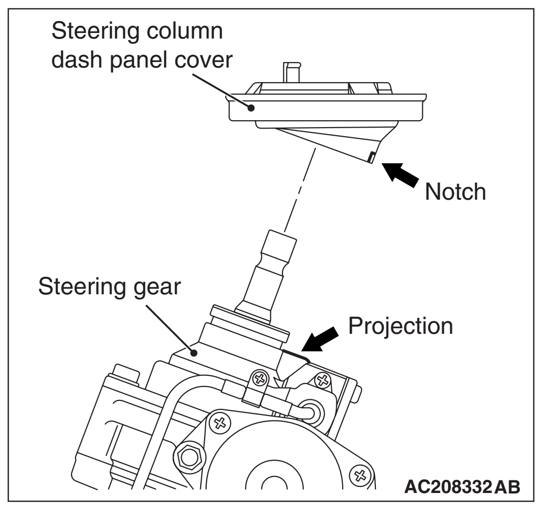
## >>A<< STEERING GEAR CUSHION INSTALLATION




Apply the specified adhesive to the steering gear cushion and install it to the steering gear and linkage assembly as shown.

**Instant adhesive: ThreeBond 1741 or equivalent**

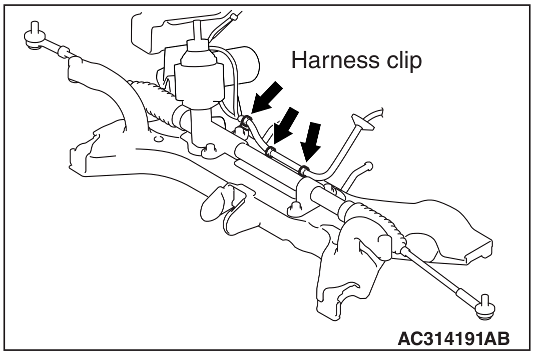
## >>B<< STEERING COLUMN DASH PANEL COVER INSTALLATION




Install the steering column dash panel cover so that the cover notch is aligned with the projection of the steering gear and linkage assembly.

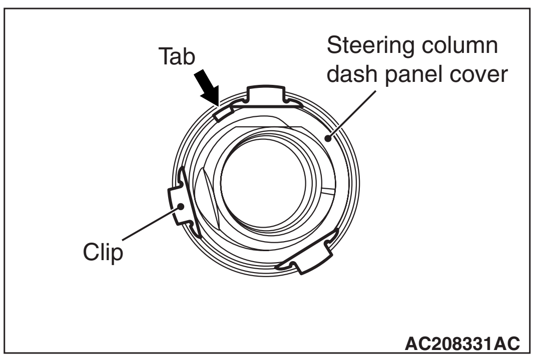
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## >>C<< STEERING GEAR AND LINKAGE ASSEMBLY INSTALLATION



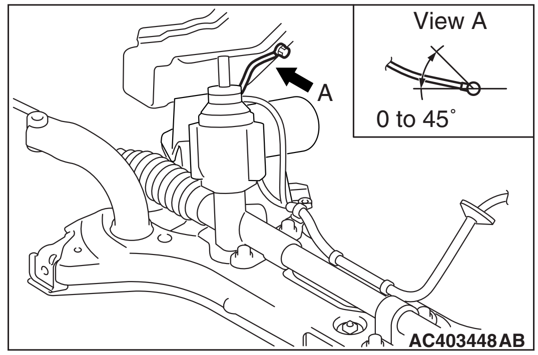

After installing the steering gear and linkage assembly to the front axle No.1 crossmember, secure the 3 harness clips of the steering gear and linkage assembly to the front axle No.1 crossmember.

## >>D<< FRONT AXLE NO.1 CROSSMEMBER (EQUIPPED WITH STEERING GEAR AND LINKAGE ASSEMBLY, STEERING COLUMN DASH PANEL COVER, STABILIZER BAR) INSTALLATION



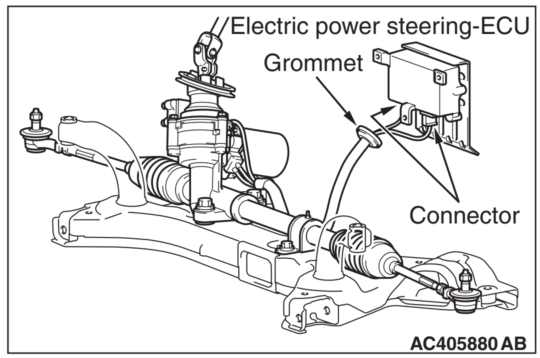

After installing the front axle No.1 crossmember to the body, pull the steering column dash panel cover tab (shown in the figure) from inside of the vehicle and secure the 3 clips to the body panel.

## >>E<< STEERING GEAR BOLT (EARTH BOLT) INSTALLATION



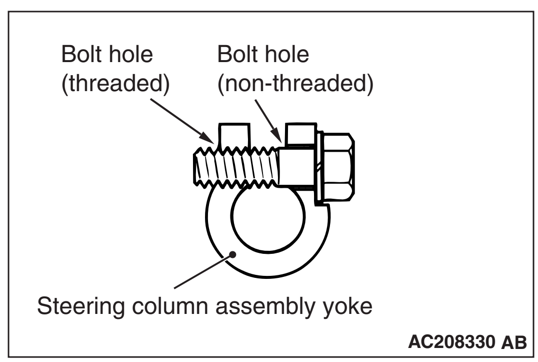

Tighten the steering gear bolt so that the earth cable is routed as shown.

## >>F<< STEERING GEAR CONNECTOR (IN-VEHICLE EPS-ECU) INSTALLATION




Firmly secure the grommet to the body panel and connect the connector to the electric power steering-ECU.

## >>G<< STEERING GEAR AND STEERING COLUMN ASSEMBLY CONNECTION




Insert the steering column bolt into the non-threaded bolt hole.

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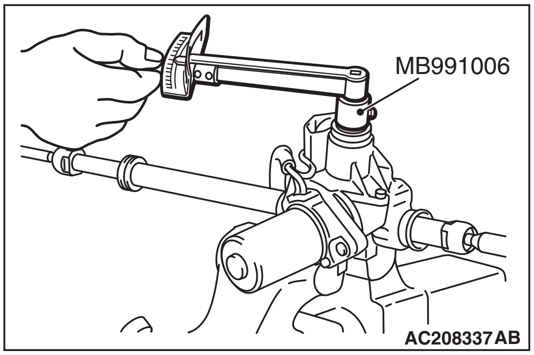
## INSPECTION

M1372011000367

### STEERING GEAR TOTAL PINION TORQUE CHECK

**⚠ CAUTION**

**When holding the steering gear in a vice, secure its mounting positions. If it is secured in any other place, the gear housing may become deformed or damaged.**




1. Using special tool preload socket (MB991006), rotate the pinion gear at the rate of one rotation in approximately 4 to 6 seconds to check the total pinion torque.

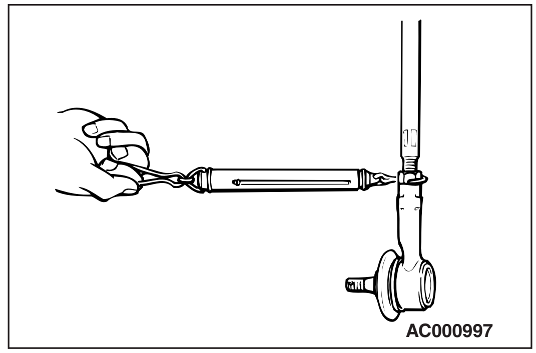
   **Standard value:**
   **TOTAL PINION TORQUE: 1.29 – 2.23 N·m**
   **Change in torque: 0.92 N·m or less**

   *NOTE: When measuring, remove the bellows from the rack housing. Measure the pinion torque through the whole stroke of the rack.*

2. If not within the specification, replace the steering gear and linkage assembly (Refer to P.37-96).

### TIE ROD SWING RESISTANCE CHECK

1. Give 10 hard swings to the tie rod.




2. Measure the tie rod swing resistance [tie rod swing torque] with a spring balance.

   **Standard value: 6 – 19 N [1.5 – 4.9 N·m]**

3. If the measured value exceeds the standard value, replace the tie rod.
4. If the measured value is below the standard value, the tie rod can be re-used if it swings smoothly without excessive play.

### TIE ROD END BALL JOINT DUST COVER CHECK

1. Check the dust cover for cracks or damage by pushing it with your finger.
2. If the dust cover is cracked or damaged, replace the tie rod end (Refer to P.37-96).

   *NOTE: Cracks or damage of the dust cover may damage the ball joint. If it is damaged during service work, replace the dust cover (Refer to P.37-96).*

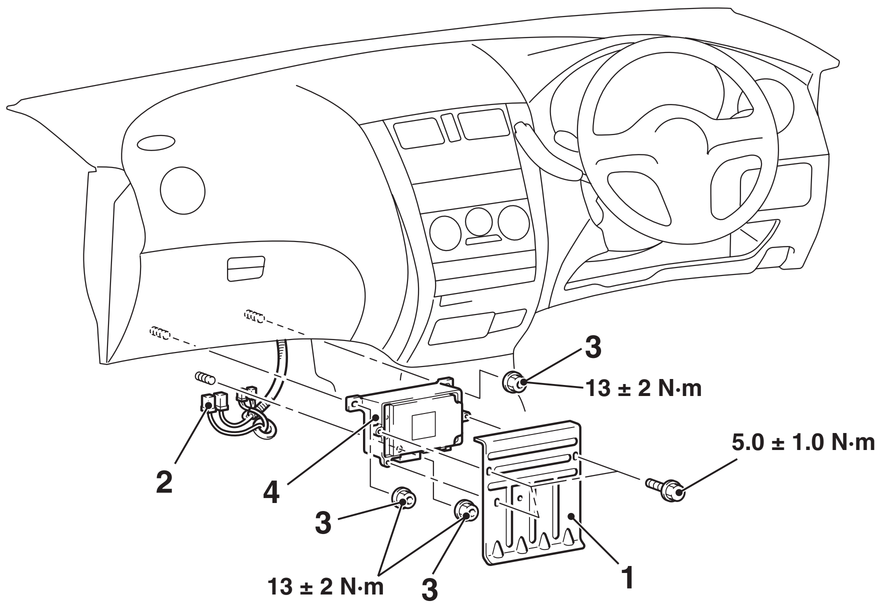
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# ELECTRIC POWER STEERING CONTROL UNIT

## REMOVAL AND INSTALLATION

M1372006300049

**Pre-removal and post-installation Operation**
Front Scuff Plate, Cowl Side Trim Removal and Installation (Refer to GROUP 52A, Trim – Interior Trim P.52A-11).




**Removal steps**

1. Electric power steering-ECU bracket
2. Electric power steering-ECU connector (4 pieces)

**Removal steps (Continued)**

3. Electric power steering-ECU equipment nut (one of three nuts is an earth nut).
4. Electric power steering-ECU